



United States
Department of
Agriculture

In cooperation with the
Montana Agricultural
Experiment Station

MT604—Dillon Area— Part of Beaverhead County, Montana



Natural
Resources
Conservation
Service



The original maps and tables have been deleted from this online version. Since the soil survey's publication, more data on soil properties may have been collected, new interpretations developed, or existing interpretive criteria modified. Maps and current data tables can be accessed through the Web Soil Survey (<http://websoilsurvey.nrcs.usda.gov/app/>).

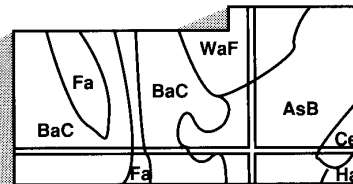
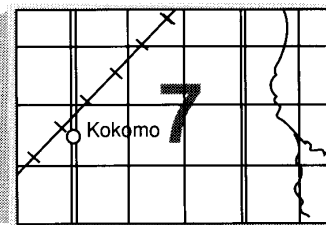
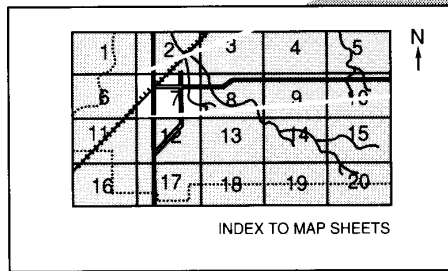
How to Use This Soil Survey

Detailed Soil Maps

The detailed soil maps can be useful in planning the use and management of small areas.

To find information about your area of interest, locate that area on the **Index to Map Sheets**.

Note the number of the map sheet and click on that sheet.



AREA OF INTEREST

NOTE: Map unit symbols in a soil survey may consist only of numbers or letters, or they may be a combination of numbers and letters.

Locate your area

of interest on the map sheet. You can locate the Section, Township, and Range by zooming in on the **Index to Map Sheets**. Note the map unit symbols that are in that area. The **Contents** lists the map units by symbol and name and shows the page where each map unit is described.

The **Summary of Tables** shows which table has data on a specific land use for each detailed soil map unit. Also see the **Contents** for sections of this publication that may address your specific needs.

National Cooperative Soil Survey

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey. This survey was made cooperatively by the Natural Resources Conservation Service and the Montana Agricultural Experiment Station. The survey is part of the technical assistance furnished to the Beaverhead County Conservation District.

Major fieldwork for this soil survey was completed in 2001. Soil names and descriptions were approved in 2003. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 2001. The most current official data are available at <http://websoilsurvey.nrcs.usda.gov/app/>.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

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Cover: Soils in the foreground are a complex of Bronec, Kalsted, and Trimad. Soils in the middle ground are a complex of Rentsac, Cabbart, and Rock outcrop. This area is known as the Hogback. The Pioneer Mountains are in the background.

Additional information about the Nation's natural resources is available online from the Natural Resources Conservation Service at <http://www.nrcs.usda.gov>.

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110A	Ryell-Rivra complex, cool, 0 to 2 percent slopes	236
77C	Sappington loam, 2 to 8 percent slopes	231
278D	Sappington-Geohrock-Delpoint, stony complex, 4 to 25 percent slopes	271
177C	Sappington-Kalsted complex, 2 to 8 percent slopes	248
277C	Sappington-Kalsted-Kalsted, stony complex, 2 to 8 percent slopes	270
225B	Scravo cobbly loam, 0 to 4 percent slopes	263
25E	Scravo, stony-Kalsted-Cabbart, 15 to 45 percent slopes	202
2213E	Sebud, stony-Surdal, stony-Poin, very stony complex, 8 to 35 percent slopes	297
33E	Shadow complex, 15 to 70 percent slopes	210
47D	Spudbar complex, 2 to 15 percent slopes	224
42E	Spudbar, extremely bouldery-Rubble land-Rock outcrop complex, 15 to 45 percent slopes	222
30B	Thess loam, 0 to 4 percent slopes	207
21B	Thess loam, cool, 0 to 4 percent slopes	198
130A	Thess-Ashbough complex, 0 to 2 percent slopes	240
130B	Thess-Scravo complex, 0 to 4 percent slopes	241
180B	Thessvo-Scravo complex, 0 to 4 percent slopes	249
9B	Threeriv-Beavrock complex, 0 to 2 percent slopes	188
1003E	Tiban, bouldery-Cheadle, very bouldery complex, 15 to 35 percent slopes	295
22E	Tiban, very stony-Maciver complex, 15 to 60 percent slopes	198
37C	Tiban-Maciver gravelly loams, 2 to 8 percent slopes	217
44E	Tiban-Philipsburg-Roxal complex, 15 to 45 percent slopes	223
39C	Trimad gravelly loam, 2 to 8 percent slopes	219
85C	Trudau loam, 2 to 8 percent slopes	233
7B	Trudau loam, cool, 2 to 8 percent slopes	186
9101E	Twinadams-Thunderhead-Blackleaf, stony complex, 8 to 25 percent slopes	301
147C	Varney clay loam, 2 to 8 percent slopes	245
333E	Varney-Delpoint, stony-Geohrock complex, 4 to 35 percent slopes	277

533D	Varney-Kalsted, stony-Cabbart, stony complex, 4 to 15 percent slopes	285
133C	Varney-Sappington complex, 2 to 8 percent slopes	242
233C	Varney-Sappington-Kalsted, stony complex, 2 to 8 percent slopes	265
433D	Varney-Udecide-Geohrock complex, 4 to 15 percent slopes	283
W	Water	305
541D	Whitlash, very stony-Brickner, stony-Rock outcrop complex, 4 to 25 percent slopes	288
241F	Whitlash, very stony-Rock outcrop-Perma, very stony complex, 25 to 60 percent slopes	266
20F	Whitore gravelly loam, 25 to 60 percent slopes, stony	197
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For tables with the most current data, please visit the
Soil Data Mart at <http://soildatamart.nrcs.usda.gov/>.

Foreword

This soil survey contains information that affects land use planning in this survey area. It contains predictions of soil behavior for selected land uses. The survey also highlights soil limitations, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, ranchers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. The information in this report is intended to identify soil properties that are used in making various land use or land treatment decisions. Statements made in this report are intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

Dave White
State Conservationist
Natural Resources Conservation Service

Soil Survey of Dillon Area—Part of Beaverhead County, Montana

By Gary F. Berger, Project Leader

Fieldwork by Gary F. Berger and Patrick E. McCain, Natural Resources Conservation Service

United States Department of Agriculture, Natural Resources Conservation Service,
in cooperation with the
Montana Agricultural Experiment Station

DILLON AREA—PART OF BEAVERHEAD COUNTY is located in south-central Montana (fig. 1). The survey area includes 355,200 acres, or about 555 square miles. Dillon, the county seat, is located in the east-central part of the county. Other Beaverhead County soil survey areas include the Red Rock Lakes Area, Horse Prairie—South Valley Area, and Beaverhead National Forest Area.

General Nature of the Survey Area

This section describes some of the environmental and cultural features that affect the use and management of soils in the survey area. These features are history and development; industry, transportation, and recreation; physiography, drainage, and geology; mining; oil, coal, and gas; geothermal resources; ground-water resources; seismicity; and climate.

History and Development

Michael Garverich, Montana Civil Engineer (Geotechnical), Natural Resources Conservation Service, prepared this section.

The first historical notice of the Dillon area comes from the 1805-1806 journals of the Lewis and Clark Expedition, which used the area as an important part of its east-west travel route. The expedition passed through the area on its way westward and again when returning east. Their guide, Sacajawea, had experience with the area prior to joining the Lewis and Clark Expedition at Fort Mandan in the Dakotas. Her ancestors and other Native American tribes had been using the area as a travel route and food source for untold generations.

About the time of the Lewis and Clark Expedition, the Blackfeet Tribes appear to have taken control of the area because of their numbers and fighting ability. The tribes made every effort to keep other peoples out of the valley and surrounding areas.

Early fur trappers were the next group of white men to use the area. In 1807, they made their first of several attempts to enter the area but the Blackfeet repulsed them. The fur trappers made additional unsuccessful attempts with continued losses. After the smallpox epidemic of 1837 decimated the Blackfeet, white men obtained reasonably safe access to the area.

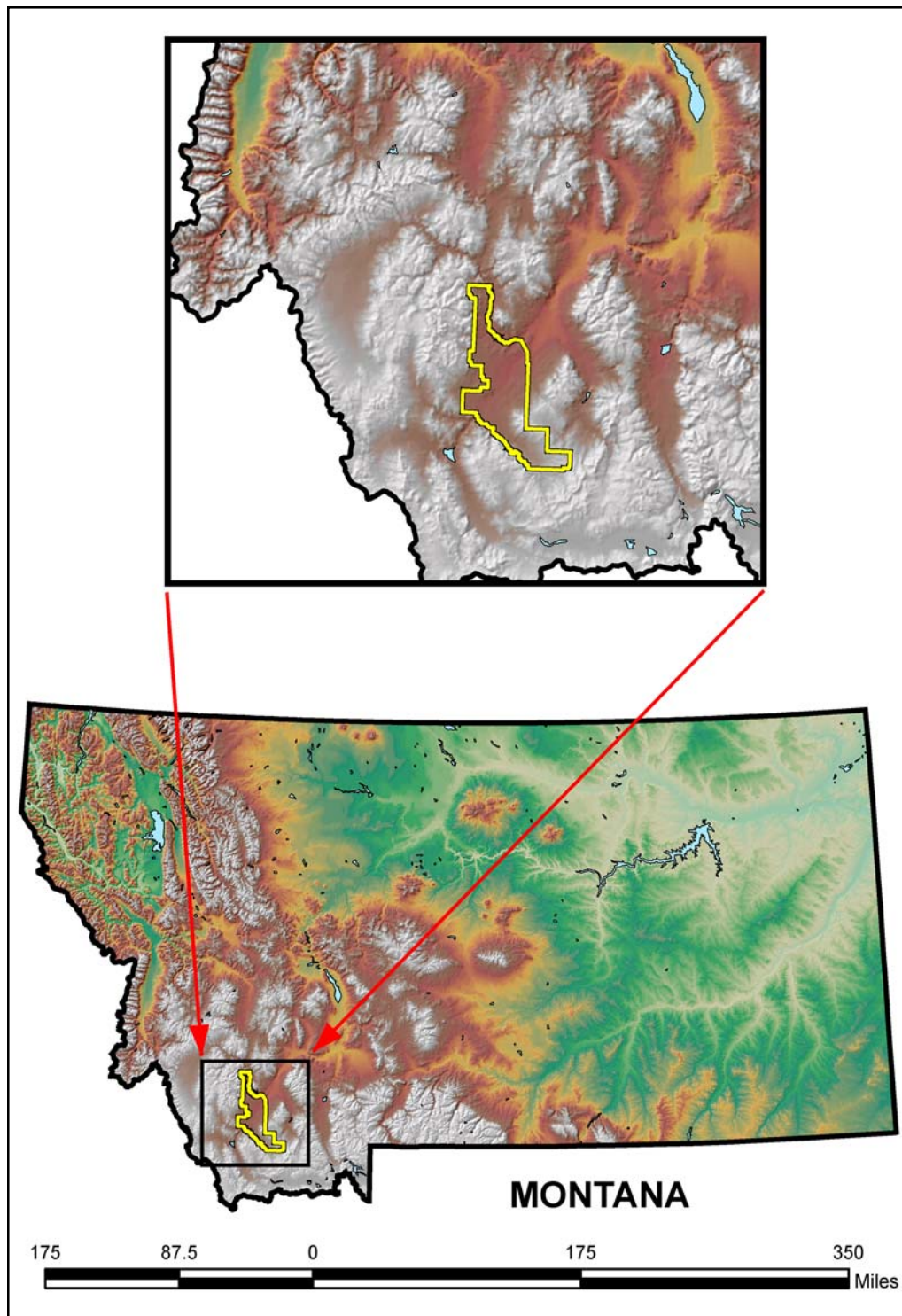


Figure 1.—Location of Dillon Area—Part of Beaverhead County, Montana

With the demise of the fur trade in the late 1830s, the area reverted to occupancy by the tribes of the region. This situation continued until the 1850s when gold was discovered in California and the Oregon Trail was established. At this time, it was discovered that the intermountain valleys of the Northern Rocky Mountains could be utilized as pasture for livestock used on the California and Oregon Trails. The earliest

ranches of the Beaverhead Valley were established at this time, and the area began to be used as part of the regional north-south line of travel.

Industry, Transportation, and Recreation

In 1862, gold was discovered on Grasshopper Creek, located southwest of Dillon, and, in 1863, at Alder Gulch, to the east. These discoveries led to an influx of people into the Beaverhead Valley and surrounding territory. Following these and other gold discoveries in the region, the existing ranching operations continued and enlarged and transportation-related businesses proliferated. Transportation-related businesses dealt with the movement of people and freight to and amongst the mining camps of the region and the railroad facilities to the south in Utah. Farming soon followed, and the population increased until the local demand for transportation induced the Union Pacific to extend their tracks through the area in 1881. This transportation facility greatly enhanced the economy of the region, and agricultural use of the area expanded. The Union Pacific and I-15, which parallels the rail line, continue to provide transportation for the area's agricultural industry.

The most stable, long-term industry of the area has been agricultural production from farming and ranching. In addition, a branch of the Montana University System is located in Dillon. In the past, numerous mineral developments have focused on the surrounding mountains. The mountains continue to provide industrial minerals in the form of talc for filler-extendors and garnets for abrasives. Gold and silver have been the most notable mineral products, but their production is at present (2005) moribund as is the production of other metallic minerals, such as copper, lead, zinc, molybdenum, and tungsten. Several petroleum exploration holes have been drilled, but all have been dry. Recent industrial developments in the area have focused on the tourism and recreational industry, but the resource base for these industries is minimal.

Communities established within the area include Dillon, a regional supply and education center; Glen, simply a place name now; Argenta, a former mining camp; and Melrose, another former mining supply center that now has minimal services.

Physiography, Drainage, and Geology

Marie V. Marshall, Montana State Geologist, Natural Resources Conservation Service, prepared this section.

Physiography

This soil survey area consists largely of the Beaverhead River Valley with the addition of a portion of the Big Hole River Valley. The area is a fault-controlled valley characteristic of the topography of southwestern Montana. The entire area lies within the Northern Rocky Mountain Physiographic Province.

The Beaverhead River Valley is irregularly shaped and surrounded by mountains. The valley is bounded by the Highland Mountains to the north, the Tobacco Root Mountains to the northeast, the Ruby Range to the east, the Snowcrest Range to the southeast, the Blacktail Range to the south, and the Pioneer Range to the west. Dissected alluvial fans and extensive pediments that have developed along the margins of the basins, including the East Bench that extends northwest off the Ruby Range flank the Beaverhead River flood plain. Other extensive pediments have developed on the flanks of the Highland Mountains east of Melrose, and another extends east into the Big Hole Valley from the Pioneer Mountains. Blacktail Deer Creek emerges onto a coalescing alluvial fan/alluvial plain complex that slopes gently northwest toward the Beaverhead River.

Within the soil survey area, elevations in the valley range from a low of 4,820 feet above sea level where the Beaverhead River exits the county, to 7,650 feet above sea level in the Rock Creek Valley at the upper end of the soil survey area. High peaks in the surrounding mountains have elevations above 9,000 feet. The city of Dillon has an elevation of approximately 5,100 feet above sea level.

Drainage

The Big Hole and Beaverhead Rivers and their tributaries drain the soil survey area. These rivers join about 10 miles downstream of the soil survey area, forming the Jefferson River, one of the three forks of the Missouri River. From north to south, the tributaries of the Big Hole River include Trapper and Camp Creeks, which join the Big Hole River at Melrose, and Cherry, McCartney, Rock, Lost, Willow, Birch, and Nez Perce Creeks.

The Beaverhead River originates at the confluence of the Red Rock River and Horse Prairie Creek. The Clark Canyon Reservoir floods Horse Prairie Creek a few miles upstream of the soil survey area. The Beaverhead River Valley immediately below Clark Canyon Reservoir is confined to a narrow canyon and opens up into a broad area at Barretts Siding at the upstream boundary of the soil survey area. From south to north, the tributaries of the Beaverhead River from the east are Blacktail Deer Creek and its smaller tributaries, which join the Beaverhead River just north of Dillon, and Carter, Cottonwood, and Trout Creeks. Frying Pan Creek joins the Beaverhead River from the west at Beaverhead Rock at the downstream end of the soil survey area.

Barretts Dam is located on the Beaverhead River at Barretts Siding and supplies water to Canyon Ditch and the East Bench Canal. Many irrigation diversions control the summertime flow of the Beaverhead River, sometimes significantly diminishing the flow.

Geologic History and Regional Geology

Geologic Time Scale

Age	Era	Period	Epoch	Years Before Present million years ago = mya
	Cenozoic	Quaternary	Holocene	11,800 years to present
			Pleistocene	1.806 mya to 11,800 years
		Tertiary	Pliocene	5.332 to 1.806 mya
			Miocene	23.03 to 5.332 mya
			Oligocene	33.9 to 23.03 mya
			Eocene	55.8 to 33.9 mya
			Paleocene	65.5 to 55.8 mya
	Mesozoic	251 to 65.5 mya		
	Paleozoic	542 to 251 mya		
Precambrian				
Proterozoic Eon				2,500 to 542 mya
Archeozoic (Archean) Eon				>3,800 to 2,500 mya

Southwestern Montana, characteristic of the Rocky Mountains, has an extremely complex geologic history, which is greatly simplified here. Because of the mineral deposits within Beaverhead County, the area has been mapped and studied extensively; it is well covered by geologic maps. Some of the mapping has been performed by students in geology field camps, representing universities from across the country.

The geologic processes that characterize the development of this area began after the intense mountain-building activity that formed the Rocky Mountains. In this area, late-Cretaceous deformation was compressional, creating a system of east-directed thrusts and sheets of sedimentary rocks and uplifts cored by crystalline basement rocks that were uplifted along steeply dipping reverse faults. Much of this movement occurred along pre-existing faults that have been reactivated periodically since Precambrian time.

Regional compression continued into early-Tertiary time, resulting in a system of northeast- and northwest-trending faults. By the late Eocene, deformation had shifted to regional extension, and the Beaverhead Basin had begun to subside. At least three generations of extensional faulting are recognized in the soil survey area, and they are associated with different extensional mechanisms.

The first episode of regional extension was thought to have initiated through the collapse of crust that had been over-thickened by the previous regional compression. A 100 km-wide, north-trending rift zone extending north from the Snake River Plain was formed by gravitational collapse of the materials on the western margin of the fold and thrust belt.

Regional extension down dropped the basins along a series of normal faults. Great volumes of sediment were washed into them from the surrounding mountains, forming extensive fluvial and lacustrine deposits. Volcanism began in the middle-Eocene and continued into the early Oligocene, blanketing the area with ash and producing fields of volcanic rocks with substantial quantities of andesite. The eruptive centers included the Gallatin and Absaroka Volcanic Fields to the east and the Challis and Dillon Volcanic Fields to the west.

Climate affected the characteristics of the sediment accumulating in the basins of southwestern Montana. While there were tropical periods during the mid-Miocene, most of the Tertiary was arid. In humid climates, lush vegetation prevents widespread erosion and streams carry relatively fine-grained sediment through permanent channels. In arid climates, there is less vegetation to prevent erosion, permanent streams become ephemeral, and coarser-grained sediments are laid down in flash-flood deposits, choking stream channels and spreading across the landscape. Deposits of the Renova Formation represent the first episodes of regional extension.

An episode of mid-Miocene extension formed the northeast-trending rift system—dated at 16 million years—in southwestern Montana. This extensional event ended the deposition of the Renova Formation and tilted it to the southeast. A period of regional uplift followed, and the accompanying erosion removed a large quantity of the Renova Formation. Deposition of the Six Mile Creek Formation began in the deepening basins and continued until the late Pliocene. Because of the regional tilting, the Six Mile Creek Formation was deposited in angular discordance upon the underlying Renova Formation.

Late-Cenozoic extension to the northeast that has been dated at 6 million years followed this deposition. During this time, northwest-trending faults cut and diverted the existing drainages into new, crosscutting basins. Deposits of the Six Mile Creek Formation were tilted and uplifted into new mountain ranges.

This episode is thought to relate to crustal adjustments along the margin of the track of the Yellowstone Hotspot. Hotspots occur above a stationary plume of hot rock rising within the mantle and create a track of volcanic activity as the plates move across it. Faulting has continued from the Pliocene to the present to accommodate ongoing crustal extension driven by the dynamics of the hotspot. The features formed by volcanism and extensional faulting become younger eastward.

Glaciation, volcanism, and continuing erosion and deposition have dominated the Quaternary Period. Cold, wet periods of glacial activity have alternated with drier interglacial periods. Geologists estimate that there may have been up to 20 separate glacial advances affecting Montana in the last 3 million years (Alt, 1984). During the

Pleistocene glacial advances, alpine glaciers covered the high mountain peaks, eroding U-shaped valleys and depositing linear moraines and glacial outwash in many valleys. Near the soil survey area, only the Pioneer Range was glaciated; the remainder of the area was too dry and/or too low in elevation. Glaciers extended southeast out of the Pioneer Mountains down Rattlesnake Creek, but they did not extend downstream as far as the soil survey area.

Although the changes are not as dramatic, the landscape has continued to evolve since the end of the last ice age. Today, streams and rivers are reworking alluvial deposits in the active flood plains. During periods of high runoff, these flood plains are subject to overflow from fluctuating water levels. Alluvial terraces at higher elevations along the valley floor show former river levels. These older terraces are no longer undergoing active deposition and are relatively stable. Landslides have occurred along steep slopes composed of clayey materials, and they are further modifying the topography.

Geologic Structure

The mountains surrounding the Beaverhead Basin are comprised of folded, tilted, and faulted bedrock from almost every geologic period. With some exceptions, the bedrock consists of igneous and metamorphic rocks of Precambrian age; marine and nonmarine sandstones, shales, and carbonate rocks of Paleozoic and Mesozoic age; marginal-marine and nonmarine strata of Jurassic and Cretaceous age; and andesitic volcanic rocks of late-Cretaceous and early-Tertiary ages.

The Beaverhead Basin is floored by Precambrian-aged metamorphic rocks, which are overlain by thick sequences of Tertiary basin-fill sediments that are in turn overlain by Quaternary fluvial and glacial sediments. Northeast of Dillon, geophysical gravity data indicate a depth to crystalline basement rock of about 3,000 feet and, in the lower Blacktail Deer Creek valley, depths of 1,500 to 3,300 feet.

Portions of four major fault systems extend through this area, with two predominant trends. The predominant trends include the McCartney Mountain fault zone, which extends northwest from Beaverhead Rock through the northeastern corner of the soil survey area; the Blacktail fault zone, which trends northwest between the Ruby and Blacktail Ranges and cuts off the upper end of the Beaverhead-Jefferson Basin; and the Ruby Fault Zone, which trends north-northeast at the base of the Ruby Range. The Beaverhead Rock Fault extends to the north-northeast in the center of the valley, parallel to the Ruby Fault Zone. The only known active fault systems are the northwest-trending normal faults, including the Blacktail and Sweetwater Fault Zones.

Geologic Units

The sequence of sedimentary rocks exposed in the soil survey area is summarized below, in order of decreasing age. *Formations* are defined as a succession of strata distinctive enough to constitute a basic unit for mapping, identified by similar rock type and stratigraphic section. Formations can be combined into *groups* or subdivided into *members*. Systems are the rocks deposited during a particular geologic period.

Representative soil series are listed for each formation where possible. In some cases, outcrop areas for a particular formation are small and difficult to differentiate in the field. In these cases, no soil series are correlated with the formation.

Precambrian

The oldest rocks in the soil survey are exposed in the southwestern end of the Ruby Range, where it extends into the soil survey area. These are igneous and high-grade metamorphic rocks from the late- to middle-Archean and early-Proterozoic Eons. These rocks were regionally metamorphosed about 1.8 billion years ago and were intruded by a variety of sills and dikes during the last stages of metamorphism.

Rock types include quartzofeldspathic gneiss, hornblende gneiss, amphibolite, marble, quartzite, various types of schist, and banded iron formation. Iron formation is a chemically precipitated form of iron that is commonly interbedded with chert or fine-grained quartz. Iron formation is generally of Precambrian Age and is frequently used as a low-grade iron ore.

Paleozoic “Ancient Life” and Mesozoic “Middle Life” Systems

In the soil survey area, Paleozoic and Mesozoic sedimentary rocks occur as isolated outcrops surrounded by Tertiary basin-fill sediments. The complete stratigraphic section is not present in any of the exposures because of the regional thrust faulting, and the formations are not continuous across large areas.

These rocks occur in several areas, including the northeastern part of the Pioneer Mountains in the northern tip of the area and as the steep, narrow ridges 5 miles west of Dillon above Argenta Flats. McCartney Mountain, located just north of the soil survey area, is composed of a granitic core that intruded tightly folded Mesozoic sedimentary rocks. The structure extends south into the soil survey area, forming the Hogback. This dark-colored, conspicuous ridgetop is formed by the resistant Paleozoic-aged Quadrant Quartzite that is part of a thrust sheet. Soils formed on this erosion-resistant quartzite include the Blackleaf and Twinadams series.

Beaverhead Rock is also composed of Paleozoic strata, primarily limestone of the Mississippian-aged Mission Canyon Formation. This isolated outcrop is on the up-thrown side of the northwest-trending McCartney Fault, which developed in the extensional tectonic regime of the late Miocene. The fault has down-dropped the Paleozoic section to the northeast by an estimated 4,000 feet. Soils formed on these calcareous rocks include the Crago and Pensore series.

There is a small, Cretaceous-aged granitic stock that forms the relatively low, forested hills east of the lower end of Birch Creek, above the Mantle Ranch. Soils formed on these coarse-grained igneous rocks include the Rencot and Spudbar series.

Cenozoic “Recent Life” System

Cenozoic rocks in the soil survey area consist of both volcanic rocks and the large thickness of Renova and Six Mile Creek basin-fill sediments. The most recent deposits include colluvium, alluvium, terrace gravels, and landslide debris, which are currently being deposited and reworked.

Tertiary-aged volcanic rocks are present primarily along the eastern flank of the Pioneer Mountains. These rocks are light-brownish gray to brownish gray, tinted purple in some places, fine-grained, and locally porphyritic. Rock types include basaltic andesite, andesite, dacite, and rhyodacite, and all are relatively silica enriched. The thickest sections fill old valleys that were cut into pre-Tertiary rocks. Most rocks range in age from 51 to 45 million years and are characterized by thin flows or volcanoclastic deposits that occur in broad, overlapping channels. Typical soils derived from these volcanic rocks include the Ratiopeak series.

Rattlesnake Cliffs, named by Meriwether Lewis in 1805, form the entrance to the Beaverhead River Canyon and designate the southwestern edge of the soil survey area. The cliffs are composed of Tertiary andesites that have been up-thrown on the Blacktail Fault. Typical soils derived from these volcanic rocks include the Rencot and Spudbar series.

The Beaverhead Group is the oldest basin-fill deposit in this area, deposited in the late Cretaceous or early Tertiary during a time of extensive west to east thrusting. The Beaverhead Group has been subdivided into several formations; it consists of moderately indurated, massive boulder, cobble, and pebble conglomerate with a quartz-sand matrix that has been cemented with calcite. The Beaverhead Group also contains some interbedded sandstone and freshwater limestone. In most places,

these conglomerates consist of rounded to subangular fragments of Proterozoic quartzite and Paleozoic carbonates, and the unit can be as much as 1,150-feet thick.

The Beaverhead Group is exposed in the mountains south and southwest of Argenta Flats and Barretts Siding; it occurs in the soil survey area at Burns Mountain. Typical soils formed on the Beaverhead Group include the Bronec and Geohrock series.

The younger Tertiary basin-fill sediments belong to the Bozeman Group, which has been subdivided into the Renova Formation and the Six Mile creek Formation that overlies it. The sediments vary widely in both grain size and their degree of consolidation, and individual beds grade into and interfinger with each other. Some beds are unconsolidated to semiconsolidated, and some are hard and completely lithified. The sediments are interbedded with both in-place, air-fall deposits of volcanic ash and tuff, and reworked ash, which was eroded off the hills and deposited in the basin fill. Some of the units contain bentonite, formed when volcanic ash weathers under water.

The Renova Formation contains sediments that were deposited in rivers, lakes, and marshes in a broad area of subdued topography in an arid climate. The formation is interlayered with volcanics; it consists of fine-grained, volcanic-rich mudstones, siltstones, and sandstones with interbeds of limestone and lenses of cemented gravels. The nonresistant mudstones and friable sandstones erode into deeply gullied badlands. In most of the soil survey area, the Renova Formation is overlain by the younger Six Mile Creek Formation and is poorly exposed; however, there are major exposures on the eastern flank of the Ruby Range in Sweetwater Basin and in the Blacktail Range.

The Six Mile Creek sediments lie unconformably upon the beds of the Renova Formation, separated by both erosional and angular unconformities. These sediments are darker and more coarse-grained than the Renova Formation sediments and include alluvial fan, channel fill, mudflow, and debris-flow deposits. This accumulation of coarse sediments was deposited on coalescing alluvial fans at the mountain fronts and was influenced by arid climactic conditions and renewed regional uplift. The upper part of the formation includes a widespread sequence of calcareous hot spring deposits as much as 100-feet thick.

A significant amount of the Six Mile Creek Formation is exposed in the soil survey area, primarily in the foothills along the valley margins. The formation occurs on the East Bench, the pediment on the northwestern side of the Ruby Range, and on the eastern and southeastern sides of the Pioneer Mountains. Typical soils formed on this formation include the Bronec and Kalsted series.

Glacial outwash covers the valley floor of Argenta Flats and the lower Rattlesnake Creek drainage. This outwash consists of poorly sorted, bouldery gravel and sand deposited by glacial meltwater. There are moraine deposits in the Pioneer Mountains; however, none extends into the soil survey area. Typical soils formed on glacial outwash include the Nippt and Scravo series.

Quaternary surficial deposits make up the material found on the valley floors of the survey area. The deposits are characterized as mixtures of poorly sorted colluvial and alluvial fan deposits along the basin margins and fluvial deposits along the rivers and streams that include both coarse-grained channel deposits and fine-grained flood plain deposits. The fan deposits consist of poorly sorted, silty sand and gravel and include a gravel veneer covering pediment surfaces. Typical soils formed from fan deposits include the Amesha and Kalsted series. Typical soils formed from alluvium include the Beavrock and Threeriv series.

The hummocky area around Lovells Lake is a Quaternary landslide involving an area of several square miles that developed along the trace of the Blacktail Fault. There are also several large landslides in the Beaverhead River Canyon that have constricted and diverted the river at various times, including during road construction.

Landslides occur along fault traces and are likely to have been associated with major earthquakes.

Mining

Mining activity has had a significant impact on the development of Beaverhead County. Mining began in 1862 with the discovery of placer gold in the gravels of a small tributary to the Big Hole River. Three weeks later, placer gold was found in Grasshopper Creek at Bannack, beginning the development of the area that later became Montana's first territorial capital. Silver- and gold-bearing veins were found near Argenta 2 years later, and four smelters were eventually constructed along the banks of Rattlesnake Creek.

Metallic mineral deposits of the Pioneer Range consist of gold, silver, copper, lead, and tungsten. These mineral deposits are associated with small granitic intrusions and occur along the altered edges of these stocks. There are over twelve major mining districts in the Pioneer Mountains, of which the most productive has been the silver-lead deposit in the Hecla District.

The Ruby Range has mineral deposits containing gold, copper, nickel, iron, and manganese, although talc has been the principal commodity produced. Banded iron formation is present along Carter Creek on the Beaverhead-Madison County border. The Ruby Range also contains nonmetallic deposits of graphite, corundum (sapphires), marble, garnet, vermiculite, and pegmatite minerals, such as feldspar, mica, and rose quartz. Sillimanite was also mined at the southwestern end of the Ruby Range. Sillimanite is a fibrous aluminum silicate that melts at a high temperature; it is used as electrical insulation, chemical enamelware, spark plug porcelain, and high-temperature cements.

Talc deposits in the western part of the Ruby Range are more numerous than in any other area in southwestern Montana. Talc deposits occur in host rocks of Precambrian-aged dolomitic marble. In most deposits in the Ruby Range, the talc is of high purity. Although asbestiform minerals are reported in Archean metamorphic rocks, talc from this area is not known to contain these minerals.

Oil, Gas, and Coal

A number of exploratory oil and gas wells have been drilled in the valleys of Beaverhead County. The two main geological plays for oil and gas in southwestern Montana are intermontane basins filled with Tertiary-aged sediments and overthrust-related structural and stratigraphic traps. Both these situations characterize the soil survey area, and several of these exploration holes had shows of oil and gas. All of the exploration holes have been plugged and abandoned, and, at this time, there are no operating oil or gas fields in the area.

Geothermal Resources

Most of the soil survey area is designated as an area expected to contain geothermal resources suitable for direct-heat applications (Sonderegger and Bergantino, 1981). Primary exploration targets are basin-fill sediments that are receiving recharge from deep basement sources. This hot water is frequently conveyed along faults, which provide a conduit to the surface.

There are two low-temperature thermal springs located at the southern tip of the soil survey area; they are Browns Springs and Lovells Hot Springs at Lovells Lake. These thermal springs flow 4,160 L/min at 24°C, (1,100 gpm at 101°F) and 13,250 L/min at 19°C (3,500 gpm at 92°F), respectively. Lovells Hot Springs is located on the trace of the Blacktail Fault.

The area between these springs and McMenomey Ranch Spring, located to the southwest just below Clark Canyon Dam, is designated as an area where the discovery and development of additional sources of low-temperature water for direct-heat applications are highly probable.

There are two low-temperature thermal springs in the northern part of the soil survey area. There is a hot spring at Beaverhead Rock, with a flow of 380 L/min at 27°C (100 gpm at 106°F). This spring is located on the fault trace of the Beaverhead Rock Fault. The Apex Warm Spring is located near the railroad crossing at Birch Creek and has a flow of 2,840 L/min at 25°C (750 gpm at 103°F).

Ground-Water Resources

Ground-water development in the Beaverhead Basin has significantly increased over the last several decades. In addition, the area has experienced years of drought and chronic water shortages. The 1991 Montana Legislature initiated the Beaverhead Groundwater Protection Project and established a partial closure to new ground-water appropriations until the study was completed. In 1998, the Montana Bureau of Mines and Geology published the results, summarized below (Uthman and Beck, 1998).

The Beaverhead Groundwater Protection Project was conducted from 1991 through 1996 to determine the impacts of ground-water development on ground-water levels and surface water availability in the upper Beaverhead Basin. Results of the study showed that ground-water levels have not steadily declined as a result of the current level of development, but rather, fluctuate annually in response to recharge.

The rock units of the soil survey area can be divided into three groups with different aquifer characteristics. These three categories are the Precambrian- to Cretaceous-aged aquifer, the lower-Tertiary-aged aquifer, and the Quaternary, upper-Tertiary-aged aquifer.

The Precambrian- to Cretaceous-aged bedrock aquifer is located along the margins of the valley. Most of the rocks are relatively hard and impermeable. The aquifer properties are a result of secondary porosity created by the development of fractures, joints, and solution cavities. This aquifer produces only small yields to individual wells, but, as a whole, it provides significant ground-water recharge to the valley-fill aquifer.

The lower-Tertiary-aged aquifer is comprised of several thousand feet of sandy clay and siltstone that overlie crystalline basement bedrock. This thick sequence contains a large volume of ground water in storage; however, it typically has poor hydraulic properties, and yields are generally sufficient only for domestic wells.

The Quaternary, upper-Tertiary-aged aquifer includes fluvial and glacial sediments and Tertiary-aged alluvial-fan sediments that may be locally cemented. This aquifer is generally unconfined; it consists of coarse-grained sediments separated by beds of silt and clay. The aquifer ranges in total thickness from tens of feet to hundreds of feet; it is the most important and productive aquifer in Beaverhead County. Aquifer test results indicate that the hydraulic properties of this aquifer are favorable for producing and sustaining large ground-water withdrawals without causing widespread drawdown impacts.

Seismicity

Southwestern Montana is a region of high seismic hazard. Southern Beaverhead County is located within the Centennial Tectonic Belt, a westward branch of the Intermountain Seismic Belt, where most of the earthquakes in Montana occur. The Intermountain Seismic Belt is a northwestward-trending belt of shallow seismicity about 60-miles wide that, together with the Centennial Tectonic Belt, contain most of the known active faults in Montana, Idaho, Wyoming, and Utah. The Intermountain

Seismic Belt is characterized by shallow seismicity, earthquake swarms, and normal fault scarps that show evidence of Quaternary or historic movement.

Young fault scarps cutting across the landscape demonstrate continuing movement in the soil survey area. The best example in the soil survey area is the Blacktail Fault, which extends along the southern end of the valley at the foot of the Blacktail Mountains. These fault scarps cut surficial deposits and landslides, behead young alluvial fans, and disrupt present drainage patterns. Northwest-striking faults in this area are capable of generating earthquakes with a magnitude greater than a seven (Ostenaa and Wood, 1990).

The Earthquake Studies Office of the Montana Bureau of Mines and Geology has operated a regional network of seismograph stations in southwestern Montana since 1982. Analysis of the data produced has shown that the Dillon region experiences diffusely distributed seismicity at a much lower frequency than the Red Rock or Centennial Valleys to the south (Stickney, 1997). Additional information is available from the Earthquake Studies Office in Butte, Montana.

The Earthquake Studies Office has divided the state of Montana into earthquake hazard areas on a scale from five to ten. This designation uses possible Modified Mercalli intensities for sites on bedrock; it is based on historic earthquake activity and the distribution of active faults (Stickney and Musselman, 1993). Beaverhead County contains areas designated as both nine and ten, with the area south and southwest of Dillon designated as a ten. For comparison, the area around Glasgow, Montana, is designated as a five, and the area around Hebgen Lake is designated as a ten.

Climate

Prepared by the Natural Resources Conservation Service, National Water and Climate Center, Portland, Oregon.

The climate tables were created from climate station Dillon WMCE. Additional climate information for this narrative was derived from new NRCS climate maps of Montana, produced by Oregon State University using the PRISM climate mapping system.

Thunderstorm days, relative humidity, percent sunshine, and wind information are estimated from First Order stations at Missoula and Helena.

The "Temperature and Precipitation" table gives data on temperature and precipitation for the survey area as recorded at Dillon in the period 1971 to 2000. The "Freeze Dates in Spring and Fall" table shows probable dates of the last freeze in spring and the first freeze in fall. The "Growing Season" table provides data on the length of the growing season.

In summer, the average temperature is 63.0 degrees F at Dillon. The average daily maximum summer temperature is 80.5 degrees F. The highest temperature ever recorded at Dillon was 100 degrees F on August 12, 1940.

In winter, the average temperature is 25.6 degrees F at Dillon. The average daily minimum winter temperature is 14.6 degrees F. The lowest temperature ever recorded at Dillon was -40 degrees F on February 9, 1933.

Growing-degree days, equivalent to "heat units," are shown in the "Temperature and Precipitation" table. During the month, growing-degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

Average annual total precipitation across the soil survey area is highly dependent on location and elevation. Driest areas are in the northern valley section north of Dillon where between 9 and 10 inches of precipitation fall in a typical year. The southeastern part of the soil survey area and the westernmost section at highest

elevations receive the most precipitation annually. Some areas receive up to 20 inches, with 15 to 18 inches common along the southern and southeastern border. At Dillon, the average annual precipitation is 11.67 inches. Of this amount, about 5.3 inches, or 46 percent, usually falls during June through September. The growing season for most crops falls within this period. The heaviest 1-day rainfall during the period of record at Dillon was 1.94 inches on May 28, 1982. Thunderstorms occur on about 25 days each year, mostly during June through August.

The average seasonal snowfall also is highly dependent on elevation. At Dillon, the average for the year is around 35 inches, but, at slightly higher elevations, up to 70 inches per year is the norm. The greatest snow depth at any one time during the period of record at Dillon was 19 inches recorded on February 11, 1949. On average, about 50 days per year have at least 1 inch of snow on the ground at Dillon, but higher elevations have snow on the ground for up to 100 days per year. The heaviest 1-day snowfall on record at Dillon was 16.0 inches recorded on November 26, 1932.

The average relative humidity in midafternoon is about 30 percent in summer and about 70 percent in winter. Humidity is higher at night, and the average at dawn is about 80 percent in most months. The sun shines about 72 percent of the time in summer and about 40 percent of the time in winter. The prevailing wind is highly dependent on terrain. In general, the prevailing wind follows the valleys, with south winds for much of the year in the main valley but also from the north a good percentage of the time. Average wind speed is highest, around 9 miles per hour, during April and May.

How This Survey Was Made

This survey was made to provide information about the soils and miscellaneous areas in the survey area. The information includes a description of the soils and miscellaneous areas and their location and a discussion of their suitability, limitations, and management for specified uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

The soils and miscellaneous areas in the survey area are in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept or model of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining

their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Temperature and Precipitation

(Recorded in the period 1971 through 2000 at Dillon WMCE)

	Temperature (degrees F)					Precipitation (inches)					
Month	Average	Average	Average	2 years in 10 will have—		Average	Average	2 years in 10 will have—		Average	Average
	daily	daily		of	less	more		of days			
	maximum	minimum		growing- degree days*	than	than		with 0.10 or more	Total Snowfall		
				Maximum temperature more than	Minimum temperature less than						
January-----	34.7	13.3	24.0	55	-23	4	0.37	0.07	0.62	1	1.0
February----	40.7	16.8	28.8	61	-20	11	0.25	0.04	0.43	0	0.2
March-----	48.3	22.9	35.6	68	-6	43	0.66	0.29	1.01	2	1.5
April-----	57.5	29.0	43.2	78	9	151	1.22	0.48	2.00	3	0.0
May-----	66.6	36.6	51.6	85	21	364	2.25	1.15	3.33	6	0.0
June-----	75.5	43.3	59.4	90	30	578	1.87	0.94	2.79	5	0.0
July-----	83.7	47.2	65.4	95	35	789	1.19	0.45	1.74	3	0.0
August-----	82.3	45.8	64.1	94	33	743	1.18	0.47	1.85	3	0.0
September---	72.4	38.5	55.4	89	19	465	1.07	0.23	1.85	3	0.2
October-----	60.6	30.8	45.7	81	7	220	0.85	0.21	1.42	2	0.0
November----	43.3	20.8	32.0	67	-11	36	0.39	0.12	0.67	1	0.1
December----	34.5	13.6	24.1	55	-22	6	0.35	0.09	0.60	1	2.0
Yearly:											
Average---	58.3	29.9	44.1	—	—	—	—	—	—	—	—
Extreme---	99.0	-37.0	—	96	-29	—	—	—	—	—	—
Total-----	—	—	—	—	—	3,410	11.67	9.03	14.00	30	4.9

* A growing-degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40 degrees F).

Freeze Dates in Spring and Fall

(Recorded in the period 1971 through 2000 at Dillon WMCE)

Probability	Temperature		
	24 degrees F or lower	28 degrees F or lower	32 degrees F or lower
Last freezing temperature in spring: January-July			
1 year in 10 later than-----	May 17	May 29	June 26
2 years in 10 later than----	May 12	May 24	June 20
5 years in 10 later than----	May 2	May 15	June 7
First freezing temperature in fall: August-December			
1 year in 10 earlier than---	September 13	September 5	August 31
2 years in 10 earlier than--	September 18	September 10	September 4
5 years in 10 earlier than--	September 28	September 20	September 11

Growing Season

(Recorded in the period 1971 through 2000 at Dillon WMCE)

Probability	Daily minimum temperature		
	Higher than 24 degrees F	Higher than 28 degrees F	Higher than 32 degrees F
	<i>Days</i>	<i>Days</i>	<i>Days</i>
9 years in 10-----	128	105	75
8 years in 10-----	135	112	82
5 years in 10-----	148	126	96
2 years in 10-----	161	141	109
1 year in 10-----	168	148	116

Formation of the Soils

This section relates the soils in the survey area to the major factors of soil formation and describes the system of soil classification. The tables, "Taxonomic Classification of the Soils" and "Acreage and Proportionate Extent of the Soils," show the classification and extent of the soils in this survey area.

Factors of Soil Formation

Soil is a natural, three-dimensional body on the earth's surface. Soil has properties that result from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over time.

Although there are many different soils, each soil is the result of the interaction of the same five factors. These factors are the effect of climate on the parent material, the kinds of plants and organisms living in the soil, the relief of the land, the physical and chemical composition of the parent material, and the length of time it took for the soil to form.

Within short distances, the combination of these factors varies, and, consequently, the soils that form differ in fertility, productivity, and physical and chemical characteristics. In the following paragraphs, the factors of soil formation are discussed as they relate to the soils in the survey area.

Parent Material

Most of the soils in the survey area formed in alluvium derived from mixed sources or from material weathered from bedrock. Types of this bedrock include andesite, basalt, limestone, quartzite, rhyolite, sandstone, gneiss, and schist.

Soils, such as the Libeg and Philipsburg series, that formed in quartzites are generally loamy. Soils, such as the Amesha and Kalsted series, that formed in calcareous alluvium are loamy or sandy. Soils, such as the Beavrock and Dillon series, that formed in alluvium are loamy over gravels.

Many soils in the survey area have accumulated lime from the parent material. Lime affects the availability of plant nutrients, especially phosphorus.

Climate

Temperature and precipitation mainly determine climate, an active force in the formation of soils. In the Dillon Area—Part of Beaverhead County, winters are cold; springs are cool and moist; and summers are warm and dry. Soils form in rocks that have been broken into suitable materials by erosion and alternate freezing and thawing. Chemical reactions, such as solution and hydration, further break down this weathered material.

Precipitation and temperature affect the kind and amount of vegetation that grows on the soil. Vegetation decays to produce organic matter in the soil. Soils that have cool temperatures and high precipitation generally contain more organic matter and are dark colored. Soils that have warm temperatures and low precipitation generally contain less organic matter and are light colored.

In the survey area, the mean annual precipitation ranges from 10 to 24 inches. The mean annual temperature ranges from 34 to 44 degrees F.

Topography

Topography, or relief, is determined by glaciation and mountain formation and by the age and resistance of geologic formations to erosion by wind and water. Topography influences soil development through its effect on drainage and runoff. On the terrace edges of this survey area, runoff water has carved drainages. These rugged areas contrast sharply with the smoother areas of the terrace surfaces.

The number and distinctness of soil horizons generally decrease as slope increases. Soils on steep slopes with rapid runoff have many characteristics similar to those of soils formed in arid climates. Examples of this general principle are the Scravo soil that is moderately steep or steep and the Amesha soil that is nearly level to moderately sloping.

Living Organisms

Living organisms are active in the formation of soils. Plants, animals, insects, and microorganisms affect gains or losses in organic matter, plant nutrients, and changes in porosity and structure.

Roots, rodents, and insects penetrate the soil and alter its structure. Microorganisms, chemicals in the soil, and insects change leaves, roots, and entire plants that remain in the surface layer to humus. Fungi and algae also contribute to the decomposition of bedrock. Animals increase porosity by burrowing through the soil and leaving open channels for the movement of water and air. Common rodents in the survey area are ground squirrel and rabbit. Some of the fragments on the surface of terraces, and on many other areas, were dug up by burrowing rodents.

Vegetation in this survey area consists mainly of short grasses, mid grasses, and shrubs in the valleys and coniferous forests in the Blacktail and Sweetwater areas.

Time

Change taking place in soils over a long period is called soil genesis. As a result of these changes, distinct horizons, or layers, develop in the soils. The length of time that parent materials have been in place and exposed to climate and living organisms is generally reflected in the degree to which the soil profile has developed. The kind and arrangement of these horizons are called soil morphology. These layers are described in terms of chemistry, color, consistence, permeability, structure, texture, and thickness.

Soils are classified according to their approximate age, from young to mature. Age, or maturity, of a soil is generally indicated by the thickness and distinctness of subsurface horizons, content of organic matter and clay, depth to which soluble material is leached, and form and distribution of calcium carbonate and gypsum in the soil.

Young soils show very little profile development. Rivra gravelly sandy loam, a soil of the Entisol order, is an example of a young soil. It is on a flood plain adjacent to a stream. The soil has accumulated enough organic matter to form a thin A horizon but has little clay accumulation and little translocation of carbonates within the profile.

The Varney soil formed in parent material that is similar to the parent material of the Rivra gravelly sandy loam but is older. These soils also formed in alluvium on older, more stable, alluvial fans and stream terraces. They have accumulated enough organic matter to have a thick, dark-colored A horizon; they have distinct clay

accumulation in a B horizon; and nearly all of the carbonates have been leached below a depth of 20 inches.

Many of the sloping and steep, shallow, and very shallow soils appear to have been in the process of formation for about as long as some of the more developed, less sloping soils. However, erosion has removed the soil as fast as it formed. In this case, the effect of time has been offset by the effect of relief.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (Soil Survey Staff, 1999 and 2003). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. The table, "Taxonomic Classification of the Soils," shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Twelve soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Inceptisol, from *inceptum*, meaning beginning.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Ustept (*Ust*, meaning soil with an ustic moisture regime, plus *ept*, from Inceptisols).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; type of saturation; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Calciustepts (*Calci*, meaning soils that have a calcic horizon, plus *ustept*, the suborder of the Inceptisol that has an ustic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic subgroup is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other taxonomic class. Each subgroup is identified by one or more adjectives preceding the name of the great group. An example is Aridic Calciustepts.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineralogy class, cation-exchange activity class, soil temperature regime, soil depth, and reaction class. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is coarse-loamy, mixed, superactive, frigid Aridic Calciustepts.

SERIES. The series consists of soils within a family that have horizons similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile.

The "Taxonomic Classification of the Soils" table indicates the order, suborder, great group, subgroup, and family of the soil series in the survey area.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the "Soil Survey Manual" (Soil Survey Division Staff, 1993) and in the "Field Book for Describing and Sampling Soils" (Schoeneberger and others, 2002). Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" (Soil Survey Staff, 1999) and in "Keys to Soil Taxonomy" (Soil Survey Staff, 2003). Unless otherwise indicated, colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

Adel Series

Depth class: Very deep

Drainage class: Well drained

Permeability: Moderate to moderately slow

Landform: Hills and swales

Parent material: Alluvium and colluvium derived from mixed rock sources

Slope range: 0 to 60 percent

Elevation range: 6,400 to 8,000 feet

Annual precipitation: 15 to 19 inches

Annual air temperature: 34 to 38 degrees F

Frost-free period: 30 to 70 days

Taxonomic Class: Fine-loamy, mixed, superactive Pachic Haplocryolls

Typical Pedon

Adel loam, in an area of Philipsburg-Tiban-Adel complex, 15 to 45 percent slopes, in an area of rangeland, 2 300 feet east and 2,100 feet south of the northwest corner of sec. 16, T. 10 S., R. 5 W. Swamp Creek topographic quadrangle (lat. 45°57'58"N; long. 112°13'18"W)

A1—0 to 8 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; strong fine and medium granular structure; hard, very friable, slightly sticky, slightly plastic; common medium and coarse and many very fine and fine roots; neutral; clear smooth boundary.

A2—8 to 24 inches; very dark grayish brown (10YR 3/2) silt loam, very dark brown (10YR 2/2) moist; strong fine and medium subangular blocky structure; hard, very friable, moderately sticky, moderately plastic; many very fine, fine, and medium roots; neutral; clear wavy boundary.

A3—24 to 33 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak medium and coarse subangular blocky structure; very hard, friable, moderately sticky, moderately plastic; common very fine and fine roots; neutral; clear wavy boundary.

Bw1—33 to 45 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak coarse subangular blocky structure; very hard, firm, moderately sticky, very plastic; few very fine and fine roots; neutral; gradual wavy boundary.

Bw2—45 to 60 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; weak coarse subangular blocky structure; extremely hard, firm, moderately sticky, very plastic; neutral.

Range in Characteristics

Mean annual soil temperature: 36 to 40 degrees F

Mean annual soil temperature, summer: 52 to 59 degrees F

Moisture control section: Between 4 and 12 inches

Thickness of the mollic epipedon: 16 to 60 inches

Note: Some pedons have a C horizon that has hues of 10YR or 2.5Y, value of 5 or 6 dry and 3, 4, or 5 moist, and chroma of 1, 2, or 3

A1 horizon

Value: 2 to 4 dry; 2 or 3 moist

Chroma: 1 or 2

Clay content: 18 to 25 percent

Content of rock fragments: 0 to 15 percent gravel

Reaction: pH 6.1 to 7.3

A2 horizon

Value: 3 to 5 dry; 2 or 3 moist

Chroma: 1 or 2

Texture: Loam or silt loam

Clay content: 18 to 27 percent

Content of rock fragments: 0 to 15 percent gravel

Reaction: pH 6.1 to 7.8

A3 horizon

Value: 3 to 5 dry; 2 to 4 moist

Chroma: 1 or 2

Texture: Loam or silt loam

Clay content: 18 to 27 percent

Content of rock fragments: 0 to 15 percent gravel

Reaction: pH 6.1 to 7.8

Bw horizons

Hue: 10YR or 2.5Y

Value: 4 to 6 dry; 3 to 5 moist

Chroma: 2 or 3

Texture: Loam, clay loam, or silty clay loam

Clay content: 18 to 35 percent

Content of rock fragments: 0 to 15 percent gravel

Reaction: pH 6.1 to 7.8

Amesha Series

Depth class: Very deep

Drainage class: Well drained

Permeability: Moderate

Landform: Fans, terraces, and hills

Parent material: Calcareous alluvium

Slope range: 0 to 60 percent

Elevation range: 4,800 to 6,500 feet

Annual precipitation: 10 to 14 inches

Annual air temperature: 38 to 42 degrees F

Frost-free period: 70 to 105 days

Taxonomic Class: Coarse-loamy, mixed, superactive, frigid Aridic Calciustepts

Typical Pedon

Amesha loam, 0 to 4 percent slopes, in an area of cropland, 200 feet north and 400 feet west of the southeast corner of sec. 24, T. 6 S., R. 9 W. Bond topographic quadrangle (lat. 45°57'58"N; long. 112°13'18"W)

- Ap—0 to 4 inches; pale brown (10YR 6/3) loam, brown (10YR 4/3) moist; moderate medium and coarse subangular blocky structure; hard, friable, moderately sticky, moderately plastic; common medium and many fine roots; strongly effervescent; moderately alkaline; clear smooth boundary.
- Bk1—4 to 14 inches; very pale brown (10YR 7/3) loam, brown (10YR 5/3) moist; weak medium and coarse subangular blocky structure; hard, friable, moderately sticky, moderately plastic; common fine and medium roots; common fine masses of lime; violently effervescent; moderately alkaline; clear smooth boundary.
- Bk2—14 to 32 inches; pale yellow (2.5Y 7/3) loam, light yellowish brown (2.5Y 6/3) moist; weak medium and coarse subangular blocky structure; hard, friable, moderately sticky, moderately plastic; common very fine and fine roots; 5 percent gravel; many coarse masses of lime; continuous distinct lime casts on undersides of rock fragments; violently effervescent; moderately alkaline; gradual wavy boundary.
- Bk3—32 to 50 inches; pale yellow (2.5Y 7/3) sandy loam, light yellowish brown (2.5Y 6/3) moist; weak coarse subangular blocky structure; slightly hard, very friable, moderately sticky, nonplastic; few very fine roots; 10 percent gravel; many coarse masses of lime; continuous distinct lime casts on undersides of rock fragments; violently effervescent; moderately alkaline; clear smooth boundary.
- BC—50 to 60 inches; pale yellow (2.5Y 7/3) gravelly sandy loam, light brownish gray (2.5Y 6/2) moist; massive; soft, very friable, slightly sticky, nonplastic; 15 percent gravel; disseminated lime; violently effervescent; moderately alkaline.

Range in Characteristics

Mean annual soil temperature: 40 to 47 degrees F

Moisture control section: Between 8 and 24 inches; dry in all parts between four-tenths and five-tenths of the cumulative days per year when the soil temperature at a depth of 20 inches is 41 degrees F or higher

Depth to the Bk horizon: 3 to 7 inches

A horizon

Hue: 10YR or 2.5Y

Value: 5 to 7 dry; 4 to 6 moist

Chroma: 2 or 3

Texture: Loam, silt loam, or sandy loam

Clay content: 12 to 20 percent

Content of rock fragments: 0 to 40 percent—0 to 20 percent cobbles; 0 to 20 percent gravel

Reaction: pH 7.4 to 8.4

Bk1 horizon

Hue: 10YR or 2.5Y

Value: 5 to 7 dry; 4 to 6 moist

Chroma: 2 or 3

Texture: Loam or silt loam

Clay content: 10 to 18 percent

Content of rock fragments: 0 to 15 percent—0 to 5 percent cobbles; 0 to 15 percent gravel

Calcium carbonate equivalent: 15 to 35 percent

Reaction: pH 7.9 to 8.4

Bk2 horizon

Hue: 10YR or 2.5Y
 Value: 6 to 8 dry; 5 to 7 moist
 Chroma: 2 or 3
 Texture: Loam or silt loam
 Clay content: 10 to 18 percent
 Content of rock fragments: 0 to 15 percent—0 to 5 percent cobbles; 0 to 15 percent gravel
 Calcium carbonate equivalent: 15 to 35 percent
 Reaction: pH 7.9 to 8.4

Bk3 horizon

Hue: 10YR or 2.5Y
 Value: 6 to 8 dry; 5 to 7 moist
 Chroma: 2 or 3
 Texture: Loam or sandy loam
 Clay content: 10 to 18 percent
 Content of rock fragments: 0 to 15 percent—0 to 5 percent cobbles; 0 to 15 percent gravel
 Calcium carbonate equivalent: 15 to 35 percent
 Reaction: pH 7.9 to 8.4

BC horizon

Hue: 10YR or 2.5Y
 Value: 6 to 8 dry; 5 to 7 moist
 Chroma: 2 to 4
 Texture: Loam or sandy loam
 Clay content: 10 to 18 percent
 Content of rock fragments: 0 to 35 percent—0 to 5 percent cobbles; 0 to 30 percent gravel
 Calcium carbonate equivalent: 10 to 25 percent
 Reaction: pH 7.9 to 8.4

Anamac Series

Depth class: Very deep

Drainage class: Well drained

Permeability: Moderate

Landform: Alluvial fans, stream terraces, and hills

Parent material: Alluvium from sandstone, argillite, and fine-grained igneous rocks

Slope range: 0 to 15 percent

Elevation range: 4,000 to 5,000 feet

Annual precipitation: 10 to 14 inches

Annual air temperature: 38 to 44 degrees F

Frost-free period: 90 to 115 days

Taxonomic Class: Fine-loamy, mixed, superactive, frigid Aridic Haplustolls

Typical Pedon

Anamac loam, in an area of cropland, 50 feet north and 2,190 feet east of the southwest corner of sec. 34, T. 2 N., R. 4 W. Jefferson County, Montana.

Ap—0 to 4 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak thick platy structure parting to strong fine and medium granular; slightly hard, very friable, slightly sticky, slightly plastic; few fine and coarse and

many very fine roots; few medium and many very fine and fine pores; slightly alkaline; abrupt smooth boundary.

Bw—4 to 12 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; weak medium and coarse subangular blocky structure parting to strong fine and medium granular; slightly hard, friable, slightly sticky, slightly plastic; few fine and coarse and many very fine roots; few medium, common fine, and many very fine tubular and interstitial pores; slightly alkaline; clear smooth boundary.

Bk1—12 to 18 inches; pale brown (10YR 6/3) loam, brown (10YR 4/3) moist; weak medium and coarse prismatic structure parting to strong medium and coarse subangular blocky; slightly hard, friable, slightly sticky, slightly plastic; few fine and coarse and common very fine roots; few medium, common fine, and many very fine tubular and interstitial pores; 5 percent gravel; disseminated lime; few fine masses of lime; distinct lime coats on undersides of rock fragments; strongly effervescent; moderately alkaline; clear wavy boundary.

Bk2—18 to 31 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; weak coarse prismatic structure parting to weak fine and medium subangular blocky; slightly hard, friable, slightly sticky, slightly plastic; few medium and common very fine roots; common fine and many very fine tubular and interstitial pores; 5 percent gravel; disseminated lime; few fine masses of lime; distinct lime coats on undersides of rock fragments; violently effervescent; moderately alkaline; gradual wavy boundary.

BC—31 to 60 inches; very pale brown (10YR 7/4) loam, yellowish brown (10YR 5/4) moist; massive; soft, very friable, slightly sticky, slightly plastic; few coarse and common very fine roots; many very fine tubular and interstitial pores; 5 percent gravel; violently effervescent; moderately alkaline.

Ashbough Series

Depth class: Very deep

Drainage class: Moderately well drained

Permeability: Moderate above, and rapid in, the 2C horizon

Landform: Flood plains and stream terraces

Parent material: Alluvium

Slope range: 0 to 4 percent

Elevation range: 4,500 to 6,500 feet

Annual precipitation: 10 to 14 inches

Annual air temperature: 38 to 42 degrees F

Frost-free period: 70 to 105 days

Taxonomic Class: Fine-loamy, mixed, superactive, frigid Torrifluventic Haplustepts

Typical Pedon

Ashbough silt loam, in an area of Thess-Ashbough complex, 0 to 2 percent slopes, in an area of pastureland, 2,400 feet north and 300 feet west of the southeast corner of sec. 18, T. 7 S., R. 8 W. Dillon East topographic quadrangle (lat. 45°12'00"N; long. 112°37'30"W)

A—0 to 4 inches; grayish brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) moist; weak fine and medium granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine, fine, and medium roots; few fine and many very fine tubular pores; disseminated lime; strongly effervescent; moderately alkaline; clear smooth boundary.

Bw—4 to 12 inches; pale brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; slightly hard, very

friable, moderately sticky, moderately plastic; common very fine, fine, and medium roots; many very fine and fine tubular and interstitial pores; disseminated lime; strongly effervescent; moderately alkaline; clear wavy boundary.

- C1—12 to 22 inches; pale brown (10YR 6/3) loam, including thin strata of very fine sandy loam and sandy loam, brown (10YR 5/3) moist; massive; slightly hard, very friable, moderately sticky, slightly plastic; common very fine and fine roots; few fine and many very fine tubular and interstitial pores; disseminated lime; strongly effervescent; moderately alkaline; clear wavy boundary.
- C2—22 to 43 inches; light yellowish brown (2.5Y 6/3) loam, including thin strata of very fine sandy loam and sandy loam, light olive brown (2.5Y 5/3) moist; massive; soft, very friable, slightly sticky, nonplastic; common very fine and fine roots; few fine and many very fine tubular and interstitial pores; disseminated lime; violently effervescent; moderately alkaline; gradual wavy boundary.
- Cg1—43 to 51 inches; light gray (2.5Y 7/2) silt loam, including thin strata of loam and sandy loam, light brownish gray (2.5Y 6/2) moist; common medium distinct light yellowish brown (10YR 6/4) moist redox concentrations; massive; slightly hard, very friable, moderately sticky, moderately plastic; few very fine and fine roots; few fine and common very fine tubular and interstitial pores; disseminated lime; violently effervescent; moderately alkaline; clear smooth boundary.
- Cg2—51 to 61 inches; light brownish gray (2.5Y 6/2) sandy loam, including thin strata of silt loam and loam, grayish brown (2.5Y 5/2) moist; common fine distinct light yellowish brown (10YR 6/4) moist redox concentrations; massive; soft, very friable, nonsticky, nonplastic; disseminated lime; violently effervescent; moderately alkaline; clear smooth boundary.
- 2C—61 to 84 inches; grayish brown (2.5Y 5/2) extremely gravelly sand, dark grayish brown (2.5Y 4/2) moist; single grain; loose, nonsticky, nonplastic; 70 percent gravel; slightly effervescent; moderately alkaline.

Range in Characteristics

Mean annual soil temperature: 42 to 46 degrees F

Moisture control section: Between 4 and 12 inches; dry in all parts between four-tenths and five-tenths of the cumulative days per year when the soil temperature at a depth of 20 inches is 41 degrees F or higher

Depth to the 2C horizon: 40 to >60 inches

Depth to the seasonal high water table: 42 to 60 inches

Soil phase: Saline

Note: Some pedons have a thin (<3 inches) Oe horizon.

A horizon

Hue: 10YR or 2.5Y

Value: 5 or 6 dry; 3 or 4 moist

Chroma: 2 or 3

Texture: Loam or silt loam

Clay content: 15 to 27 percent

Content of rock fragments: 0 to 10 percent gravel

Electrical conductivity: 0 to 4 mmhos/cm (saline phase: 4 to 8 mmhos/cm)

Calcium carbonate equivalent: 5 to 30 percent

Reaction: pH 6.6 to 8.4

Bw horizon

Hue: 10YR or 2.5Y

Value: 6 or 7 dry; 3 to 5 moist

Chroma: 1 to 3

Texture: Sandy loam, loam, or silt loam

Clay content: 18 to 25 percent
 Content of rock fragments: 0 to 10 percent gravel
 Electrical conductivity: 0 to 4 mmhos/cm (saline phase: 4 to 16 mmhos/cm)
 Calcium carbonate equivalent: 10 to 30 percent
 Reaction: pH 7.9 to 8.4

C horizons

Hue: 10YR, 2.5Y, or 5Y
 Value: 4, 6, or 7 dry; 3 to 6 moist
 Chroma: 1 to 4
 Texture: Sandy clay loam, loam, silt loam, or silty clay loam
 Clay content: 18 to 35 percent
 Content of rock fragments: 0 to 10 percent gravel
 Electrical conductivity: 0 to 2 mmhos/cm (saline phase: 2 to 16 mmhos/cm)
 Calcium carbonate equivalent: 5 to 30 percent
 Reaction: pH 7.9 to 8.4

Cg horizons

Hue: 2.5Y or 5Y
 Value: 6 to 8 dry; 5 to 7 moist
 Chroma: 1 or 2
 Texture: Sandy loam, sandy clay loam, loam, or silt loam
 Clay content: 15 to 27 percent
 Content of rock fragments: 0 to 15 percent gravel
 Electrical conductivity: Less than 2 mmhos/cm
 Calcium carbonate equivalent: 5 to 30 percent
 Reaction: pH 7.4 to 8.4

2C horizon

Hue: 2.5Y or 5Y
 Value: 5 or 6 dry; 4 or 5 moist
 Chroma: 1 or 2
 Texture: Loamy sand, loamy coarse sand, sand, or coarse sand
 Clay content: 0 to 10 percent
 Content of rock fragments: 35 to 80 percent—0 to 15 percent cobbles; 35 to 70 percent gravel
 Calcium carbonate equivalent: 0 to 15 percent
 Reaction: pH 7.4 to 8.4

Attewan Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderate to 22 inches and rapid below
Landform: Stream terraces and alluvial fans
Parent material: Alluvium
Slope range: 0 to 8 percent
Elevation range: 4,500 to 6,500 feet
Annual precipitation: 10 to 14 inches
Annual air temperature: 38 to 42 degrees F
Frost-free period: 70 to 105 days

Taxonomic Class: Fine-loamy over sandy or sandy-skeletal, mixed, superactive, frigid Aridic Argiustolls

Typical Pedon

Attewan loam, in an area of Attewan-Nippt complex, 0 to 2 percent slopes, in an area of rangeland, 300 feet south and 1,500 feet west of the northeast corner of sec. 25, T. 7 S., R. 10 W. Burns Mountain topographic quadrangle (lat. 45°12'07"N; long. 112°46'09"W)

- A—0 to 6 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; weak fine and medium subangular blocky structure parting to very fine and fine granular; soft, very friable, slightly sticky, slightly plastic; few fine and many very fine roots; 10 percent gravel; neutral; clear smooth boundary.
- Bt—6 to 11 inches; yellowish brown (10YR 5/4) clay loam, dark yellowish brown (10YR 4/4) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; slightly hard, friable, moderately sticky, slightly plastic; few fine and many very fine roots; common faint patchy clay films on faces of peds; 10 percent gravel; slightly alkaline; clear smooth boundary.
- Bk1—11 to 17 inches; light gray (2.5Y 7/2) loam, light brownish gray (2.5Y 6/2) moist; weak medium prismatic structure parting to moderate fine and medium subangular blocky; slightly hard, friable, slightly sticky, slightly plastic; few fine and many very fine roots; 10 percent gravel; disseminated lime; common fine and medium soft masses of lime; violently effervescent; moderately alkaline; clear smooth boundary.
- Bk2—17 to 22 inches; light gray (2.5Y 7/2) gravelly loam, light yellowish brown (2.5Y 6/3) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; few fine and common very fine roots; 5 percent cobbles and 25 percent gravel; disseminated lime; continuous distinct carbonate coats on rock fragments; violently effervescent; moderately alkaline; clear smooth boundary.
- 2C—22 to 60 inches; light brownish gray (2.5Y 6/2) extremely gravelly sand, light olive brown (2.5Y 5/3) moist; single grain; loose, nonsticky, nonplastic; 15 percent cobbles and 50 percent gravel; slightly effervescent; slightly alkaline.

Range in Characteristics

Mean annual soil temperature: 40 to 47 degrees F

Moisture control section: Between 4 and 12 inches

Thickness of the mollic epipedon: 7 to 9 inches; may include part or all of the argillic horizon

Depth to the Bk horizon: 10 to 15 inches

Depth to the 2C horizon: 20 to 40 inches

Ap horizon

Hue: 10YR or 2.5Y

Value: 5 dry; 3 moist

Chroma: 2 or 3

Clay content: 15 to 25 percent

Content of rock fragments: 0 to 15 percent gravel

Reaction: pH 6.6 to 7.8

Bt horizon

Hue: 10YR or 2.5Y

Value: 5 or 6 dry; 3 or 4 moist

Chroma: 3 or 4

Clay content: 27 to 35 percent

Content of rock fragments: 0 to 15 percent gravel

Reaction: pH 6.6 to 7.8

Bk horizons

Hue: 10YR or 2.5Y

Value: 7 or 8 dry; 5 or 6 moist

Chroma: 2 to 4

Texture: Sandy loam, loam, or silt loam

Clay content: 15 to 25 percent

Content of rock fragments: 0 to 30 percent—0 to 5 percent stones or cobbles;
0 to 25 percent gravel

Calcium carbonate equivalent: 1 to 15 percent

Reaction: pH 7.8 to 8.6

2C horizon

Hue: 10YR or 2.5Y

Value: 4 to 7 dry; 4 or 5 moist

Chroma: 2 to 4

Texture: Loamy sand, sand, loamy coarse sand, or coarse sand

Clay content: 0 to 10 percent

Content of rock fragments: 35 to 75 percent—0 to 15 percent stones or cobbles;
35 to 60 percent gravel

Calcium carbonate equivalent: 1 to 15 percent

Reaction: pH 7.4 to 8.4

Barbarela Series*Depth class:* Moderately deep*Drainage class:* Well drained*Permeability:* Moderately slow*Landform:* Hills and mountains*Parent material:* Colluvium and residuum from gneiss and schist*Slope range:* 2 to 45 percent*Elevation range:* 6,200 to 7,200 feet*Annual precipitation:* 15 to 19 inches*Annual air temperature:* 34 to 38 degrees F*Frost-free period:* 50 to 70 days**Taxonomic Class:** Fine-loamy, mixed, superactive Ustic Argicryolls**Typical Pedon**

Barbarela sandy loam, in an area of Poin, flaggy-Barbarela-Rock outcrop complex, 8 to 25 percent slopes, in an area of rangeland, 1,100 feet east and 1,000 feet north of the southwest corner of sec. 10, T. 9 S., R. 7 W. Elk Gulch topographic quadrangle (lat. 45°03'41"N; long. 112°27'07"W)

A—0 to 8 inches; brown (10YR 5/3) sandy loam, dark brown (10YR 3/3) moist; moderate fine, medium, and coarse granular structure; soft, very friable, moderately sticky, nonplastic; few coarse, common medium, and many very fine and fine roots; 5 percent gravel; neutral; clear smooth boundary.

AB—8 to 14 inches; brown (10YR 4/3) coarse sandy loam, dark brown (10YR 3/3) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; few coarse, common medium, and many very fine and fine roots; 5 percent gravel; neutral; clear smooth boundary.

Bt—14 to 34 inches; pale brown (10YR 6/3) gravelly sandy clay loam, brown (10YR 4/3) moist; moderate medium subangular blocky structure; hard, friable, slightly

sticky, slightly plastic; few medium and coarse and common very fine and fine roots; 20 percent gravel; neutral; clear wavy boundary.
Cr—34 to 40 inches; highly weathered, decomposed gneiss bedrock that crushes to gravelly coarse sand.
R—40 to 60 inches; gneiss bedrock.

Range in Characteristics

Mean annual soil temperature: 36 to 40 degrees F

Moisture control section: Between 4 and 12 inches

Thickness of the mollic epipedon: 8 to 16 inches

Depth to the Cr horizon: 20 to 40 inches

Depth to the lithic horizon: 40 to 60 inches

A horizon

Value: 3 to 5 dry; 2 or 3 moist

Chroma: 2 or 3

Texture: Coarse sandy loam, sandy loam, or loam

Clay content: 12 to 20 percent

Content of rock fragments: 0 to 20 percent—0 to 15 percent cobbles; 0 to 5 percent gravel

Reaction: pH 6.1 to 7.3

AB horizon

Value: 3 to 5 dry; 2 or 3 moist

Chroma: 2 or 3

Clay content: 12 to 20 percent

Content of rock fragments: 0 to 20 percent—0 to 15 percent cobbles; 0 to 5 percent gravel

Reaction: pH 6.1 to 7.3

Bt horizon

Value: 4 to 6 dry; 3 to 5 moist

Chroma: 3 or 4

Clay content: 20 to 30 percent

Content of rock fragments: 10 to 35 percent—0 to 5 percent cobbles; 5 to 35 percent gravel

Reaction: pH 6.1 to 7.3

Bavdark Series

Depth class: Very deep

Drainage class: Well drained

Permeability: Moderately slow

Landform: Hillsides

Parent material: Alluvium or colluvium

Slope range: 8 to 50 percent

Elevation range: 6,200 to 7,200 feet

Annual precipitation: 17 to 24 inches

Annual air temperature: 34 to 38 degrees F

Frost-free period: 50 to 70 days

Taxonomic Class: Fine-loamy, mixed, superactive Pachic Argicryolls

Typical Pedon

Bavdark coarse sandy loam, in an area of Barbarela-Poin, stony-Bavdark complex, 4 to 15 percent slopes, in an area of rangeland, 900 feet north and 2,300 feet west of the southeast corner of sec. 33, T. 3 S., R. 3 E. Gallatin County, Montana.

- A—0 to 10 inches; dark gray (10YR 4/1) coarse sandy loam, black (10YR 2/1) moist; weak medium granular structure; soft, very friable, slightly sticky, slightly plastic; few medium and common very fine and fine roots; common fine and medium and many very fine tubular pores; 5 percent gravel; slightly acid; clear smooth boundary.
- AB—10 to 18 inches; dark gray (10YR 4/1) sandy clay loam, very dark gray (10YR 3/1) moist; moderate medium granular structure; slightly hard, very friable, slightly sticky, slightly plastic; few fine and medium and common very fine roots; few medium, common fine, and many very fine tubular pores; 5 percent gravel; slightly acid; clear smooth boundary.
- Bt1—18 to 30 inches; dark grayish brown (10YR 4/2) sandy clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; hard, very friable, moderately sticky, moderately plastic; few very fine, fine, and medium roots; few medium, common fine, and many very fine tubular pores; common faint clay films on faces of peds and lining pores; 5 percent gravel; slightly acid; clear wavy boundary.
- Bt2—30 to 42 inches; brown (10YR 5/3) sandy clay loam, very dark grayish brown (10YR 3/3) moist; moderate medium subangular blocky structure; hard, very friable, moderately sticky, slightly plastic; few very fine, fine, and medium roots; few medium, common fine, and many very fine tubular pores; common faint clay films on faces of peds and lining pores; 5 percent gravel; slightly acid; clear wavy boundary.
- C—42 to 60 inches; brown (10YR 5/3) coarse sandy loam; brown (10YR 4/3) moist; massive; slightly hard, very friable, nonsticky, nonplastic; few very fine and fine roots; few medium, common fine, and many very fine tubular pores; 10 percent gravel; slightly acid.

Range in Characteristics

Mean annual soil temperature: 36 to 40 degrees F

Moisture control section: Between 4 and 12 inches

Thickness of the mollic epipedon: 18 to 45 inches

A horizon

Value: 3 or 4 dry; 2 or 3 moist

Texture: Coarse sandy loam, sandy loam, or loam

Clay content: 12 to 25 percent

Content of rock fragments: 5 to 35 percent—0 to 5 percent stones; 0 to 5 percent cobbles; 5 to 25 percent gravel

Reaction: pH 6.1 to 7.3

AB horizon

Value: 3 or 4 dry; 2 or 3 moist

Chroma: 1 or 2

Texture: Coarse sandy loam or sandy clay loam

Clay content: 12 to 25 percent

Content of rock fragments: 5 to 25 percent—0 to 5 percent cobbles; 5 to 20 percent gravel

Reaction: pH 6.1 to 7.3

Bt1 horizon

Value: 4 or 5 dry; 3 or 4 moist

Chroma: 2 to 4

Texture: Sandy clay loam or clay loam

Clay content: 22 to 35 percent

Content of rock fragments: 5 to 25 percent—0 to 5 percent cobbles; 5 to 20 percent gravel

Reaction: pH 6.1 to 7.3

Bt2 horizon

Value: 5 or 6 dry; 3 or 4 moist

Chroma: 3 or 4

Texture: Sandy clay loam or clay loam

Clay content: 22 to 35 percent

Content of rock fragments: 5 to 25 percent—0 to 5 percent cobbles; 5 to 20 percent gravel

Reaction: pH 6.1 to 7.3

C horizon

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 3 or 4

Texture: Sandy clay loam or coarse sandy loam

Clay content: 12 to 25 percent

Content of rock fragments: 10 to 30 percent—0 to 10 percent cobbles; 10 to 20 percent gravel

Reaction: pH 6.1 to 7.3

Beaverell Series*Depth class:* Very deep*Drainage class:* Well drained*Permeability:* Moderate to 17 inches and rapid below*Landform:* Drainageways, stream terraces, and swales*Parent material:* Alluvium*Slope range:* 0 to 6 percent*Elevation range:* 4,500 to 6,500 feet*Annual precipitation:* 10 to 14 inches*Annual air temperature:* 38 to 42 degrees F*Frost-free period:* 90 to 105 days**Taxonomic Class:** Loamy-skeletal over sandy or sandy-skeletal, mixed, superactive, frigid Aridic Argiustolls**Typical Pedon**

Beaverell cobbly loam, cool, 0 to 6 percent slopes, in an area of rangeland, 2,500 feet south and 300 feet east of the northwest corner of sec. 28, T. 9 S., R. 1 E. Madison County, Montana.

- A—0 to 4 inches; brown (10YR 5/3) cobbly loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable, slightly sticky, slightly plastic; many very fine and fine roots; many very fine and fine tubular pores; 10 percent cobbles and 15 percent gravel; slightly alkaline; clear wavy boundary.
- Bt—4 to 11 inches; brown (10YR 5/3) very gravelly clay loam, dark brown (10YR 4/3) moist; moderate medium subangular blocky structure; hard, firm, moderately sticky, moderately plastic; common very fine and fine roots; common very fine

tubular pores; common faint clay films on ped faces and in pores; common distinct clay films on rock fragments; 5 percent cobbles and 35 percent gravel; slightly alkaline; clear wavy boundary.

2Bk1—11 to 17 inches; yellowish brown (10YR 5/4) very gravelly sandy loam, dark brown (10YR 4/3) moist; moderate fine subangular blocky structure; soft, very friable, slightly sticky, slightly plastic; common very fine and fine roots; common very fine and fine tubular pores; 10 percent cobbles and 35 percent gravel; slightly alkaline; abrupt wavy boundary.

2Bk2—17 to 60 inches; very pale brown (10YR 7/3) extremely gravelly loamy sand, pale brown (10YR 6/3) moist; single grain; loose, nonsticky, nonplastic; few very fine and fine roots; 10 percent cobbles and 60 percent gravel; violently effervescent; common distinct carbonate coats on undersides of rock fragments; moderately alkaline.

Range in Characteristics

Mean annual soil temperature: 40 to 47 degrees F

Moisture control section: Between 4 and 12 inches

Thickness of the mollic epipedon: 7 inches, when mixed, to 14 inches

Depth to the 2Bk2 horizon: 10 to 20 inches

A horizon

Value: 2 or 3 moist

Chroma: 2 or 3

Texture: Loam or sandy clay loam

Clay content: 10 to 30 percent

Content of rock fragments: 5 to 70 percent—0 to 40 percent stones or cobbles;
5 to 40 percent gravel

Reaction: pH 6.5 to 7.8

Bt horizon

Hue: 7.5YR or 10YR

Value: 3 to 5 dry; 2 to 4 moist

Chroma: 2 to 4

Texture: Clay loam, sandy clay loam, or loam

Clay content: 20 to 35 percent

Content of rock fragments: 35 to 60 percent—0 to 15 percent cobbles; 35 to
45 percent gravel

Reaction: pH 6.6 to 7.8

2Bk1 horizon

Hue: 10YR or 2.5Y

Value: 4 to 8 dry; 4 to 6 moist

Chroma: 2 to 4

Texture: Loamy sand, sand, or sandy loam

Clay content: 0 to 20 percent

Content of rock fragments: 35 to 75 percent—5 to 40 percent stones or cobbles;
30 to 45 percent gravel

Calcium carbonate equivalent: 5 to 15 percent

Reaction: pH 7.4 to 8.4

2Bk2 horizon

Hue: 5YR, 10YR, or 2.5Y

Value: 4 to 7 dry; 3 to 6 moist

Chroma: 2 to 4 or 6

Texture: Loamy sand, sand, loamy coarse sand, or coarse sand

Clay content: 0 to 10 percent

Content of rock fragments: 35 to 80 percent—5 to 30 percent stones or cobbles;
 30 to 60 percent gravel
 Calcium carbonate equivalent: 2 to 10 percent
 Reaction: pH 6.6 to 8.4

Beavrock Series

Depth class: Very deep

Drainage class: Poorly drained

Permeability: Moderately slow in the upper 28 inches and rapid below

Landform: Flood plains, sloughs, and drainageways

Parent material: Alluvium

Slope range: 0 to 4 percent

Elevation range: 4,500 to 6,500 feet

Annual precipitation: 10 to 14 inches

Annual air temperature: 36 to 41 degrees F

Frost-free period: 70 to 105 days

Taxonomic Class: Fine-loamy over sandy or sandy-skeletal, mixed, superactive, calcareous, frigid Typic Fluvaquents

Typical Pedon

Beavrock silt loam in an area of Rivra, cool-Beavrock complex, 0 to 4 percent slopes, in an area of rangeland, 200 feet west and 1,800 feet north of the southeast corner of sec. 21, T. 6 S., R. 7 W. Beaverhead Rock topographic quadrangle (lat. 45°23'02"N; long. 112°27'45"W)

- Oi—0 to 3 inches; mat of roots and slightly decomposed sedges and grasses; clear smooth boundary.
- A—3 to 8 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; moderate thin and medium platy structure; very hard, firm, very sticky, very plastic; many very fine, fine, medium, and coarse roots; few fine and many very fine interstitial pores; disseminated lime; violently effervescent; moderately alkaline; clear wavy boundary.
- C1—8 to 15 inches; grayish brown (2.5Y 5/2) clay loam consisting of thin strata of silty clay loam, loam, and sandy loam, dark grayish brown (2.5Y 4/2) moist; massive; very hard, firm, very sticky, very plastic; common very fine, fine, medium, and coarse roots; many very fine and fine tubular and interstitial pores; disseminated lime; strongly effervescent; moderately alkaline; clear wavy boundary.
- C2—15 to 20 inches; light brownish gray (2.5Y 6/2) clay loam consisting of thin strata of silty clay loam and sandy loam, dark grayish brown (2.5Y 4/2) moist; few fine and medium distinct brownish yellow (10YR 6/6) redox concentrations; massive; very hard, firm, very sticky, very plastic; common very fine and fine roots; few very fine tubular and interstitial pores; disseminated lime; strongly effervescent; moderately alkaline; abrupt smooth boundary.
- C3—20 to 23 inches; light yellowish brown (2.5Y 6/3) sandy loam, light olive brown (2.5Y 5/3) moist; common fine, medium, and coarse prominent brownish yellow (10YR 6/6) redox concentrations; massive; soft, very friable, nonsticky, nonplastic; few very fine roots; disseminated lime; strongly effervescent; slightly alkaline; abrupt smooth boundary.
- Cg1—23 to 28 inches; light greenish gray (10Y 7/1) silty clay loam, dark gray (N 4/) moist; many medium and coarse prominent brownish yellow (10YR 6/6) redox concentrations; massive; extremely hard, firm, very sticky, very plastic;

disseminated lime; strongly effervescent; slightly alkaline; clear smooth boundary.

2Cg2—28 to 60 inches; light greenish gray (10Y 7/1) extremely gravelly sand, dark gray (N 4/) moist; massive; loose; 10 percent cobbles and 65 percent gravel; disseminated lime; slightly effervescent; slightly alkaline.

Range in Characteristics

Mean annual soil temperature: 38 to 43 degrees F; frigid soil temperature regime

Moisture control section: Between 4 and 12 inches; aquic moisture regime

Depth to the 2C horizon: 16 to 40 inches

Depth to the seasonal high water table: 12 to 24 inches

A horizon

Hue: 10YR, 2.5Y, or 5Y

Value: 4 to 6 dry; 3 to 5 moist

Chroma: 1 or 2

Texture: Loam or silt loam

Clay content: 15 to 27 percent

Content of rock fragments: 0 to 10 percent gravel

Calcium carbonate equivalent: 10 to 30 percent

Reaction: pH 7.4 to 8.4

C horizons

Hue: 2.5Y or 5Y

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 1 to 3

Texture: Loam, sandy clay loam, clay loam, or sandy loam

Clay content: 18 to 35 percent

Content of rock fragments: 0 to 10 percent gravel

Calcium carbonate equivalent: 10 to 25 percent

Reaction: pH 7.4 to 8.4

Cg1 horizon

Hue: 10YR, 10Y, or N

Value: 5 to 7 dry; 4 or 5 moist

Chroma: 1 or 2

Texture: Sandy loam, loam, or silty clay loam

Clay content: 18 to 35 percent

Content of rock fragments: 0 to 10 percent gravel

Calcium carbonate equivalent: 5 to 15 percent

Reaction: pH 7.4 to 8.4

2Cg2 horizon

Hue: 10YR, 10Y, or N

Value: 5 to 7 dry; 4 or 5 moist

Texture: Loamy sand, loamy coarse sand, sand, or coarse sand

Clay content: 0 to 10 percent

Content of rock fragments: 35 to 85 percent—0 to 20 percent cobbles; 35 to 65 percent gravel

Calcium carbonate equivalent: 0 to 10 percent

Reaction: pH 7.4 to 8.4

Beavwan Series

Depth class: Very deep

Drainage class: Well drained

Permeability: Moderately slow to 18 inches and rapid below

Landform: Alluvial fans and outwash plains

Parent material: Alluvium and glacial outwash

Slope range: 1 to 8 percent

Elevation range: 5,800 to 6,500 feet

Annual precipitation: 12 to 14 inches

Annual air temperature: 38 to 40 degrees F

Frost-free period: 70 to 90 days

Taxonomic Class: Fine-loamy, mixed, superactive, frigid Aridic Argiustolls

Typical Pedon

Beavwan gravelly sandy loam, 2 to 8 percent slopes, in an area of rangeland, 400 feet west and 1,900 feet north of the southeast corner of sec. 31, T. 9 S., R. 7 W. Elk Gulch topographic quadrangle (lat. 45°00'18"N; long. 112°29'59"W)

A—0 to 5 inches; dark grayish brown (10YR 4/2) gravelly sandy loam, very dark grayish brown (10YR 3/2) moist; weak very fine and fine granular structure; soft, very friable, nonsticky, nonplastic; few medium and coarse and many very fine and fine roots; 15 percent gravel; neutral; clear smooth boundary.

Bt1—5 to 11 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; strong medium and coarse prismatic structure; very hard, friable, moderately sticky, moderately plastic; few medium and many very fine and fine roots; common faint clay films on faces of peds; 10 percent gravel; neutral; clear wavy boundary.

Bt2—11 to 18 inches; pale brown (10YR 6/3) gravelly sandy clay loam, brown (10YR 4/3) moist; moderate medium subangular blocky structure; very hard, friable, moderately sticky, moderately plastic; many very fine and fine roots; common faint clay films on faces of peds; 20 percent gravel; slightly alkaline; clear wavy boundary.

2Bk1—18 to 24 inches; pale brown (10YR 6/3) very gravelly sandy loam, brown (10YR 5/3) moist; weak coarse subangular blocky structure; slightly hard, very friable, slightly sticky, nonplastic; few very fine and fine roots; 5 percent cobbles; 35 percent gravel; common distinct carbonate coats on undersides of rock fragments; disseminated lime; violently effervescent; slightly alkaline; clear wavy boundary.

2Bk2—24 to 60 inches; variegated very gravelly loamy coarse sand; single grain; loose, nonsticky, nonplastic; 10 percent cobbles and 45 percent gravel; common distinct carbonate coats on rock fragments; disseminated lime; violently effervescent; moderately alkaline.

Range in Characteristics

Mean annual soil temperature: 40 to 42 degrees F

Moisture control section: Between 4 and 12 inches; dry in all parts between four-tenths and five-tenths of the cumulative days per year when the soil temperature at a depth of 20 inches is 41 degrees F or higher

Thickness of the mollic epipedon: 7 to 10 inches

Depth to sandy-skeletal material: 14 to 35 inches

Surface stones: 0 to 3 percent

Soil phase: Stony

A horizon

Value: 4 or 5 dry; 2 or 3 moist

Chroma: 2 or 3

Texture: Sandy loam or loam

Clay content: 12 to 27 percent

Content of rock fragments: 0 to 35 percent—0 to 15 percent cobbles; 0 to 20 percent gravel
Reaction: pH 6.6 to 7.3

Bt horizons

Value: 4 to 6 dry; 3 to 5 moist
Chroma: 2 or 3
Texture: Clay loam or sandy clay loam
Clay content: 20 to 35 percent
Content of rock fragments: 0 to 35 percent—0 to 10 percent cobbles; 0 to 25 percent gravel
Reaction: pH 6.6 to 7.8

2Bk1 horizon

Value: 4 to 6 dry; 4 or 5 moist
Chroma: 2 to 4
Texture: Loam or sandy loam
Clay content: 10 to 18 percent
Calcium carbonate equivalent: 5 to 10 percent
Content of rock fragments: 30 to 80 percent—5 to 40 percent cobbles; 25 to 40 percent gravel
Reaction: pH 7.4 to 8.4

2Bk2 horizon

Texture: Loamy coarse sand, loamy sand, sand, or coarse sand
Clay content: 0 to 10 percent
Calcium carbonate equivalent: 5 to 10 percent
Content of rock fragments: 35 to 80 percent—10 to 40 percent cobbles; 25 to 50 percent gravel
Reaction: pH 7.4 to 8.4

Beeftrail Series

Depth class: Moderately deep

Drainage class: Somewhat excessively drained

Permeability: Rapid over very slowly

Landform: Hillslopes, ridges, mountain flanks, and bedrock-floored pediments

Parent material: Residuum from granite or other coarse-grained igneous or metamorphic rocks

Slope range: 4 to 45 percent

Elevation range: 5,500 to 6,800 feet

Annual precipitation: 15 to 19 inches

Annual air temperature: 36 to 40 degrees F

Frost-free period: 50 to 70 days

Taxonomic Class: Sandy, mixed Ustic Haplocryolls

Typical Pedon

Beeftrail coarse sandy loam, in an area of grassland, 2,100 feet south and 1,150 feet east of the northwest corner of sec. 11, T. 2 N., R. 8 W. Butte South topographic quadrangle (lat. 45°56'23"N; long. 112°33'55"W) Silver Bow County, Montana.

A1—0 to 3 inches; dark grayish brown (10YR 4/2) coarse sandy loam, very dark brown (10YR 2/2) moist; moderate medium granular structure; soft, very friable, slightly sticky, slightly plastic; common fine and medium and many very fine roots; 10 percent, mainly fine, gravel; moderately acid; clear smooth boundary.

A2—3 to 8 inches; very dark grayish brown (10YR 3/2) coarse sandy loam, very dark brown (10YR 2/2) moist; moderate medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; few fine and medium and many very fine roots; few very fine and fine tubular pores; 10 percent, mainly fine, gravel; slightly acid; clear wavy boundary.

Bw—8 to 14 inches; brown (10YR 5/3) gravelly coarse sandy loam, brown (10YR 4/3) moist; moderate medium to coarse subangular blocky structure; slightly hard, very friable, slightly sticky, nonplastic; few fine and medium and common very fine roots; few very fine tubular pores; 20 percent, mainly fine, gravel; slightly acid; gradual wavy boundary.

BC—14 to 26 inches; pale brown (10YR 6/3) gravelly loamy coarse sand, brown (10YR 5/3) moist; single grain; loose, nonsticky; nonplastic; few very fine roots; common fine and medium and many very fine interstitial pores; 30 percent, mainly fine, gravel; slightly acid; clear wavy boundary.

Cr—26 to 35 inches; soft, weathered granite bedrock.

R—35 to 60 inches; hard granite bedrock.

Blackleaf Series

Depth class: Shallow

Drainage class: Well drained

Permeability: Moderate

Landform: Strike ridges

Parent material: Residuum derived from hard sandstone

Slope range: 4 to 60 percent

Elevation range: 5,000 to 6,500 feet

Annual precipitation: 10 to 14 inches

Annual air temperature: 38 to 43 degrees F

Frost-free period: 70 to 105 days

Taxonomic Class: Loamy-skeletal, mixed, superactive, frigid Lithic Haplustalfs

Typical Pedon

Blackleaf very channery sandy loam, in an area of Haxby-Blackleaf-Zbart complex, 4 to 25 percent slopes, in an area of rangeland, 600 feet south and 700 feet west of the northeast corner of sec. 32, T. 4 S., R. 9 W. Glen topographic quadrangle (lat. 45°27'03"N; long. 112°43'59"W)

A—0 to 4 inches; light brownish gray (2.5Y 6/2) very channery sandy loam, olive brown (2.5Y 4/3) moist; weak fine and medium subangular blocky structure parting to weak fine granular; soft, very friable, slightly sticky, nonplastic; few fine and common very fine roots; common very fine and fine interstitial pores; 40 percent channers; neutral; clear smooth boundary.

Bt—4 to 8 inches; brown (10YR 5/3) very channery sandy clay loam, brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; few fine and common very fine roots; common very fine and fine tubular and interstitial pores; common faint clay films bridging sand grains and on faces of peds; 40 percent channers; slightly alkaline; clear smooth boundary.

Bk—8 to 13 inches; light yellowish brown (2.5Y 6/3) extremely channery loam, light olive brown (2.5Y 5/3) moist; weak fine granular structure; soft, very friable, slightly sticky, slightly plastic; few fine and common very fine roots; common very fine and fine tubular and interstitial pores; 15 percent flagstones and 55 percent

channers; disseminated lime; common distinct lime casts on undersides of rock fragments; strongly effervescent; slightly alkaline.
 R—13 inches; hard fractured sandstone.

Range in Characteristics

Mean annual soil temperature: 40 to 44 degrees F; frigid soil temperature regime
Moisture control section: Between 4 and 12 inches or between 4 inches and the lithic contact when bedrock is less than 12 inches. Ustic moisture regime: dry in all parts between four-tenths and five-tenths of the cumulative days per year when the soil temperature at a depth of 20 inches is 41 degrees F or higher
Depth to the argillic horizon: 3 to 7 inches
Depth to the lithic contact: 10 to 20 inches

A horizon

Hue: 10YR or 2.5Y
 Value: 5 or 6 dry; 4 moist
 Chroma: 2 to 4
 Texture: Sandy loam, loam, or sandy clay loam
 Clay content: 10 to 25 percent
 Content of rock fragments: 20 to 60 percent—0 to 20 percent flagstones; 20 to 40 percent channers
 Reaction: pH 6.6 to 7.4

Bt horizon

Hue: 10YR or 2.5Y
 Value: 5 or 6 dry; 4 or 5 moist
 Chroma: 2 to 4
 Texture: Sandy clay loam, clay loam, or loam
 Clay content: 20 to 35 percent
 Content of rock fragments: 35 to 70 percent—0 to 20 percent flagstones; 35 to 50 percent channers
 Reaction: pH 6.6 to 7.4

Bk horizon

Hue: 10YR or 2.5Y
 Value: 5 or 6 dry; 4 or 5 moist
 Chroma: 2 to 4
 Texture: Loam or sandy loam
 Clay content: 18 to 27 percent
 Content of rock fragments: 35 to 80 percent—0 to 20 percent flagstones; 35 to 60 percent channers
 Calcium carbonate equivalent: 1 to 5 percent
 Reaction: pH 7.4 to 8.4

Blacksheep Taxadjunct

Depth class: Shallow
Drainage class: Well drained
Permeability: Moderately rapid
Landform: Hogbacks and strike ridges
Parent material: Residuum or colluvium from sandstone, limestone, and igneous rock
Slope range: 4 to 45 percent
Elevation range: 4,800 to 5,400 feet
Annual precipitation: 10 to 14 inches

Annual air temperature: 39 to 42 degrees F

Frost-free period: 90 to 105 days

Taxonomic Class: Loamy, mixed, superactive, calcareous, frigid Aridic Lithic Ustorthents

Typical Pedon

Blacksheep Taxadjunct sandy loam, in an area of Kalsted-Blacksheep-Rock outcrop complex, 4 to 15 percent slopes, in an area of rangeland, 1,400 feet east and 1,800 feet north of the southwest corner of sec. 11, T. 5 S., R. 8 W. Block Mountain topographic quadrangle (lat. 45°24'48"N; long. 112°33'48"W)

A—0 to 2 inches; light yellowish brown (2.5Y 6/3) sandy loam, light olive brown (2.5Y 5/3) moist; weak fine and medium subangular blocky structure parting to weak very fine and fine granular; soft, very friable, nonsticky, nonplastic; many fine, medium, and coarse roots; strongly effervescent; moderately alkaline; abrupt smooth boundary.

C1—2 to 12 inches; pale yellow (2.5Y 7/3) sandy loam, light yellowish brown (2.5Y 6/3) moist; weak medium and coarse subangular blocky structure; slightly hard, friable, nonsticky, nonplastic; common fine, medium, and coarse roots; few fine masses of lime; violently effervescent; moderately alkaline; clear wavy boundary.

C2—12 to 16 inches; pale yellow (2.5Y 7/3) sandy loam, light yellowish brown (2.5Y 6/3) moist; massive; soft, very friable, nonsticky, nonplastic; few very fine roots; 10 percent gravel; disseminated lime; violently effervescent; moderately alkaline.

R—16 to 60 inches; hard sandstone.

Range in Characteristics

Mean annual soil temperature: 40 to 47 degrees F

Moisture control section: Between 8 inches and the lithic contact; dry in all parts between four-tenths and five-tenths of the cumulative days per year when the soil temperature at a depth of 20 inches is 41 degrees F or higher

Depth to the lithic horizon: 6 to 22 inches

Note: Some pedons have a paralithic contact above the lithic contact.

A horizon

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 or 3

Clay content: 10 to 15 percent

Content of rock fragments: 0 to 15 percent gravel

Reaction: pH 7.9 to 8.4

C1 horizon

Value: 5 to 7 dry; 5 or 6 moist

Chroma: 2 or 3

Clay content: 10 to 18 percent

Content of rock fragments: 0 to 15 percent gravel

Calcium carbonate equivalent: 5 to 10 percent

Reaction: pH 7.9 to 8.4

C2 horizon

Value: 5 to 7 dry; 5 or 6 moist

Chroma: 2 or 3

Clay content: 10 to 15 percent

Content of rock fragments: 0 to 15 percent gravel

Calcium carbonate equivalent: 5 to 10 percent

Reaction: pH 7.9 to 8.4

Blaine Series

Depth class: Moderately deep

Drainage class: Well drained

Permeability: Moderate

Landform: Hills and ridges

Parent material: Colluvium derived from igneous rock

Slope range: 2 to 15 percent

Elevation range: 5,000 to 7,000 feet

Annual precipitation: 15 to 19 inches

Annual air temperature: 34 to 38 degrees F

Frost-free period: 30 to 70 days

Taxonomic Class: Loamy-skeletal, mixed, superactive Ustic Argicryolls

Typical Pedon

Blaine stony loam, 2 to 15 percent slopes, in an area of rangeland, 2,500 feet north and 600 feet west of the southeast corner of sec. 6, T. 6 S., R. 2 W. Madison County, Montana.

A—0 to 6 inches; brown (10YR 4/3) stony loam, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky structure; soft, very friable, slightly sticky, slightly plastic; 5 percent rounded stones; 5 percent rounded cobbles; 10 percent gravel; neutral; abrupt wavy boundary.

Bt—6 to 10 inches; dark yellowish brown (10YR 4/4) very stony clay loam, dark brown (10YR 3/3) moist; strong fine subangular blocky structure; hard, firm, moderately sticky, moderately plastic; common moderately thick clay films on faces of peds; 15 percent rounded stones and 25 percent angular gravel; neutral; clear wavy boundary.

Bk1—10 to 19 inches; yellowish brown (10YR 5/6) very stony loam, dark yellowish brown (10YR 3/6) moist; weak medium subangular blocky structure; soft, very friable, slightly sticky, slightly plastic; 20 percent angular stones and 35 percent angular gravel; mildly alkaline; abrupt wavy boundary.

Bk2—19 to 25 inches; very pale brown (10YR 8/4) extremely stony loam, light yellowish brown (10YR 6/4) moist; massive; soft, very friable, slightly sticky, slightly plastic; 40 percent angular stones and 30 percent angular gravel; disseminated lime; common distinct carbonate coats on rock fragments; violently effervescent; mildly alkaline; gradual wavy boundary.

Range in Characteristics

Mean annual soil temperature: 38 to 42 degrees F

Moisture control section: Between 4 and 12 inches

Thickness of the mollic epipedon: 16 to 60 inches

A horizon

Value: 4 or 5 dry; 2 or 3 moist

Chroma: 1 to 3

Clay content: 18 to 25 percent

Content of rock fragments: 0 to 80 percent—0 to 25 percent stones or cobbles;

0 to 50 percent gravel

Reaction: pH 6.1 to 7.8

Bt horizon

Value: 4 to 6 dry; 2, 3, 4, or 5 moist

Chroma: 2 to 4

Texture: Loam, clay loam, or sandy clay loam

Clay content: 22 to 35 percent
 Content of rock fragments: 35 to 70 percent—5 to 30 percent stones or cobbles;
 25 to 55 percent gravel
 Reaction: pH 6.6 to 7.8

Bk horizons

Value: 5 to 8 dry; 4 to 6 moist
 Chroma: 2 to 4 or 6
 Texture: Loam, sandy loam, or sandy clay loam
 Clay content: 10 to 25 percent
 Content of rock fragments: 35 to 80 percent—10 to 35 percent stones or cobbles;
 25 to 60 percent gravel
 Calcium carbonate equivalent: 5 to 15 percent
 Reaction: pH 7.4 to 8.4

Blossberg Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Moderately slow to the 2C horizon and rapid below
Landform: Flood plains and low stream terraces
Parent material: Alluvium
Slope range: 0 to 4 percent
Elevation range: 4,800 to 6,200 feet
Annual precipitation: 10 to 14 inches
Annual air temperature: 38 to 42 degrees F
Frost-free period: 70 to 105 days

Taxonomic Class: Fine-loamy over sandy or sandy-skeletal, mixed, superactive, frigid Typic Endoaquolls

Typical Pedon

Blossberg loam, 0 to 4 percent slopes, in an area of pastureland, 2,400 feet south and 200 feet west of the northeast corner of sec. 6, T. 6 N., R. 9 W. Powell County, Montana

- A—0 to 14 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; many large prominent yellowish brown (10YR 5/6) redox concentrations; moderate fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine, fine, medium, and coarse roots; many very fine and fine irregular pores; neutral; clear smooth boundary.
- Bg1—14 to 23 inches; dark grayish brown (2.5Y 4/2) loam, grayish brown (2.5Y 5/2) dry; many large prominent yellowish brown (10YR 5/8) redox concentrations; moderate medium subangular blocky structure; slightly hard, very friable, slightly sticky, moderately plastic; many very fine roots; many very fine and fine irregular pores; 5 percent cobbles; slightly alkaline; gradual smooth boundary.
- Bg2—23 to 28 inches; grayish brown (2.5Y 5/2) gravelly loam, light brownish gray (2.5Y 6/2) dry; few fine prominent red (2.5YR 5/8) redox concentrations; moderate medium subangular blocky structure; slightly hard, very friable, slightly sticky, moderately plastic; many very fine and fine roots; many very fine and fine irregular pores; 5 percent cobbles; 20 percent gravel; slightly alkaline; gradual wavy boundary.
- 2Cg—28 to 60 inches; dark grayish brown (10YR 4/2) very cobbly loamy coarse sand; light brownish gray (10YR 6/2) dry; common large prominent red (2.5YR 5/8) redox concentrations; single grain; loose, nonsticky, nonplastic; many very

fine and fine roots; many very fine and fine irregular pores; 35 percent cobbles and 20 percent gravel; slightly alkaline.

Range in Characteristics

Mean annual soil temperature: 41 to 47 degrees F

Moisture control section: Between 4 and 12 inches

Depth to the seasonal high water table: 12 to 24 inches

Depth to the 2Cg horizon: 20 to 40 inches

Thickness of the mollic epipedon: 10 to 24 inches

A horizon

Value: 3 or 2 moist; 3 to 5 dry

Redox concentrations: 10YR 4/4 or 10YR 4/6 moist; 10YR 5/6 or 10YR 5/8 dry

Clay content: 18 to 27 percent clay

Content of rock fragments: 0 to 15 percent—0 to 5 percent cobbles; 0 to 10 percent gravel

Reaction: pH 6.6 to 7.8

Bg1 horizon

Hue: 10YR, 2.5Y, or 5Y

Value: 3 or 4 moist; 5 or 6 dry

Chroma: 2 or 3

Redox concentrations: 10YR 4/4 or 10YR 4/6 moist; 10YR 5/6 or 10YR 5/8 dry

Texture: Clay loam, loam, or silty clay loam

Clay content: 18 to 35 percent

Content of rock fragments: 0 to 15 percent—0 to 5 percent cobbles; 0 to 10 percent gravel

Reaction: pH 7.4 to 8.4

Bg2 horizon

Hue: 10YR, 2.5Y, or 5Y

Value: 5 or 4 moist; 5 or 6 dry

Chroma: 1 or 2

Redox concentrations: 2.5YR 4/6 or 2.5YR 4/8 moist; 2.5YR 5/6 or 2.5YR 5/8 dry

Texture: Loam or sandy loam

Clay content: 10 to 20 percent

Content of rock fragments: 20 to 40 percent—5 to 15 percent cobbles; 15 to 25 percent gravel

Reaction: pH 7.4 to 8.4

2Cg horizon

Value: 5 or 4 moist; 6 or 7 dry

Chroma: 2 or 3

Redox concentrations: 2.5YR 4/6 or 2.5YR 4/8 moist; 2.5YR 5/6 or 2.5YR 5/8 dry

Texture: Coarse sand, loamy coarse sand, or sand

Clay content: 0 to 10 percent

Content of rock fragments: 35 to 60 percent—25 to 35 percent cobbles; 10 to 25 percent gravel

Reaction: pH 7.4 to 8.4

Bonebasin Series

Depth class: Very deep

Drainage class: Very poorly drained

Permeability: Moderate in the A and Cg horizons and rapid in the sandy-skeletal material

Landform: Low stream terraces and flood plains

Parent material: Recent alluvium from mixed rock sources

Slope range: 0 to 4 percent

Elevation range: 3,800 to 6,200 feet

Annual precipitation: 10 to 20 inches

Annual air temperature: 38 to 44 degrees F

Frost-free period: 70 to 115 days

Taxonomic Class: Fine-loamy over sandy or sandy-skeletal, mixed, superactive, frigid Fluvaquentic Endoaquolls

Typical Pedon

Bonebasin loam, in an area of pastureland, 1,200 feet south and 1,500 feet west of the northeast corner of sec. 4, T. 5 N., R. 4 W. Jefferson County, Montana.

Oe—0 to 2 inches; very dark grayish brown (10YR 3/2) stony loam, mucky-peat, black (10YR 2/1) moist; neutral; clear smooth boundary.

A—2 to 8 inches; dark gray (10YR 4/1) loam, very dark gray (10YR 3/1) moist; many faint yellowish red (5YR 5/6) redox concentrations; moderate medium subangular blocky structure; slightly hard, firm, moderately sticky, slightly plastic; many very fine and fine roots; common very fine and fine interstitial and tubular pores; neutral.

Ag—8 to 15 inches; grayish brown (2.5Y 5/2) loam, very dark grayish brown (2.5Y 3/2) moist; many distinct yellowish red (5YR 5/6) redox concentrations; common faint very dark gray (5Y 3/1) redox depletions; moderate medium subangular blocky structure; slightly hard, very friable, moderately sticky, slightly plastic; many very fine roots; many very fine and fine pores; neutral; clear smooth boundary.

Cg1—15 to 21 inches; brown (7.5YR 5/2) gravelly sandy loam, dark brown (7.5YR 4/2) moist; common distinct strong brown (7.5YR 5/6) redox concentrations; common faint very dark gray (5Y 3/1) redox depletions; massive; slightly hard, very friable, slightly sticky, nonplastic; many very fine roots; common very fine and fine interstitial and tubular pores; 25 percent gravel; neutral.

Cg2—21 to 25 inches; grayish brown (10YR 5/2) loam, dark brown (10YR 3/3) moist; few faint yellowish red (5YR 5/6) redox concentrations; many distinct very dark gray (5Y 3/1) redox depletions; massive; slightly hard, very friable, slightly sticky, slightly plastic; many very fine roots; many very fine and fine interstitial and tubular pores; 5 percent gravel; neutral; clear smooth boundary.

2C—25 to 60 inches; brown (7.5YR 5/2) extremely gravelly loamy sand and sand, dark brown (7.5YR 4/2) moist; common distinct yellowish red (5YR 5/6) redox concentrations; single grain; loose, nonsticky, nonplastic; few very fine and fine roots; 15 percent cobbles, 50 percent gravel; neutral.

Branham Series

Depth class: Moderately deep

Drainage class: Well drained

Permeability: Moderate to 22 inches and rapid below

Landform: Hills

Parent material: Residuum and colluvium derived from granitic gneiss

Slope range: 4 to 35 percent

Elevation range: 5,800 to 7,000 feet

Annual precipitation: 15 to 19 inches

Annual air temperature: 36 to 40 degrees F

Frost-free period: 50 to 70 days

Taxonomic Class: Coarse-loamy, mixed, superactive Ustic Haplocryolls

Typical Pedon

Branham coarse sandy loam, 2 to 8 percent slopes, in an area of rangeland, 500 feet east and 300 feet south of the center of sec. 8, T. 2 S., R. 6 W. Madison County, Montana.

A1—0 to 2 inches; grayish brown (10YR 5/2) coarse sandy loam, very dark brown (10YR 2/2) moist; weak fine granular structure; soft, very friable, nonsticky, nonplastic; many very fine roots; 10 percent gravel; medium acid; abrupt smooth boundary.

A2—2 to 4 inches; brown (10YR 5/3) coarse sandy loam, very dark brown (10YR 2/2) moist; moderate fine subangular blocky structure; soft, very friable, nonsticky, nonplastic; common very fine roots; many very fine tubular pores; 10 percent gravel; moderately acid; clear smooth boundary.

Bw—4 to 22 inches; brown (10YR 5/3) gravelly coarse sandy loam, dark brown (10YR 4/3) moist; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky, nonplastic; common very fine roots; many very fine and fine tubular pores; few thin clay films bridging sand grains; 25 percent gravel; neutral; clear smooth boundary.

BC—22 to 30 inches; very pale brown (10YR 7/3) and white (10YR 8/2) dry or moist gravelly coarse sand; single grain; loose, nonsticky, nonplastic; few very fine roots; 30 percent gravel; slightly alkaline.

R—30 inches; granite.

Range in Characteristics

Mean annual soil temperature: 37 to 40 degrees F

Mean annual soil temperature, summer: 52 to 59 degrees F

Moisture control section: Between 4 and 12 inches

Thickness of the mollic epipedon: 7 to 12 inches

Depth to the lithic contact: 20 to 40 inches; typically 24 to 32 inches

Note: Some pedons have a Cr horizon above the lithic contact.

A horizons

Value: 3 to 5 dry; 2 or 3 moist

Chroma: 1 to 3

Clay content: 8 to 27 percent

Content of rock fragments: 0 to 35 percent—0 to 15 percent cobbles; 0 to 20 percent gravel

Reaction: pH 5.6 to 7.3

Bw horizon

Value: 4 or 5 dry; 3 or 4 moist

Chroma: 2 to 4

Texture: Coarse sandy loam or sandy loam

Clay content: 10 to 18 percent

Content of rock fragments: 10 to 35 percent—0 to 10 percent cobbles; 10 to 25 percent gravel

Reaction: pH 6.1 to 7.8

BC horizon

Value: 5 to 8 dry; 4 to 8 moist

Chroma: 2 to 4

Texture: Coarse sand or loamy coarse sand
Clay content: 4 to 10 percent
Content of rock fragments: 15 to 35 percent—0 to 5 percent cobbles; 15 to 30 percent gravel
Reaction: pH 6.1 to 7.8

Brickner Series

Depth class: Shallow
Drainage class: Well drained
Permeability: Moderate
Landform: Escarpments, ridges, and hills
Parent material: Residuum from hard, fine-grained sandstone or igneous rock
Slope range: 4 to 60 percent
Elevation range: 5,500 to 6,200 feet
Annual precipitation: 15 to 19 inches
Annual air temperature: 36 to 40 degrees F
Frost-free period: 70 to 90 days

Taxonomic Class: Loamy-skeletal, mixed, superactive, frigid Lithic Haplustalfs

Typical Pedon

Brickner gravelly sandy clay loam, in an area of Brickner, stony-Whitlash, very stony-Rock outcrop complex, 35 to 60 percent slopes, in an area of forestland, 2,550 feet north and 875 feet east of the southwest corner of sec. 13, T. 1 N., R. 2 W. Jefferson County, Montana.

- Oi—1/2 inch to 0; forest litter of partially decomposed needles, twigs, and leaves.
A—0 to 3 inches; brown (10YR 4/3) gravelly sandy clay loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable, slightly sticky, nonplastic; many very fine and fine roots; 25 percent angular gravel; neutral; clear wavy boundary.
Bt—3 to 8 inches; dark yellowish brown (10YR 4/4) very gravelly sandy clay loam, brown (10YR 4/3) moist; moderate medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; few medium and common very fine and fine roots; common very fine and fine tubular pores; common faint brown (10YR 4/3) clay films on faces of peds and bridging sand grains; 5 percent angular cobbles and 35 percent angular gravel; moderately acid; clear wavy boundary.
BC—8 to 12 inches; yellowish brown (10YR 5/4) extremely gravelly coarse sandy loam, dark yellowish brown (10YR 4/4) moist; weak fine subangular blocky structure; slightly hard, friable, slightly sticky, nonplastic; few medium and common very fine and fine roots; 15 percent angular cobbles and 55 percent angular gravel; moderately acid.
R—12 inches; hard, fractured, fine-grained sandstone.

Range in Characteristics

Mean annual soil temperature: 38 to 42 degrees F
Moisture control section: Between 4 and 12 inches or between 4 inches and the lithic contact when bedrock is less than 12 inches
Depth to the Bt horizon: 3 to 5 inches
Depth to the lithic contact: 10 to 20 inches
Surface stones and boulders: 0 to 3 percent

A horizon

Value: 4 or 5 dry; 3 or 4 moist

Chroma: 2 or 3

Texture: Loamy coarse sand, loam, or sandy clay loam

Clay content: 10 to 25 percent

Content of rock fragments: 15 to 50 percent—0 to 15 percent cobbles; 15 to 30 percent gravel

Reaction: pH 6.1 to 7.3

Bt horizon

Hue: 10YR or 2.5Y

Value: 4 or 5 dry; 3 or 4 moist

Chroma: 2 to 4

Clay content: 20 to 30 percent

Content of rock fragments: 35 to 60 percent—0 to 10 percent cobbles; 35 to 50 percent gravel

Reaction: pH 5.6 to 7.3

BC horizon

Hue: 10YR or 2.5Y

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 to 4

Texture: Sandy loam, coarse sandy loam, or sandy clay loam

Clay content: 12 to 25 percent

Content of rock fragments: 45 to 70 percent—0 to 5 percent stones; 0 to 15 percent cobbles; 45 to 60 percent gravel

Reaction: pH 5.6 to 7.3

Bridger Series

Depth class: Very deep

Drainage class: Well drained

Permeability: Moderately slow

Landform: Hills and alluvial fans

Parent material: Alluvium from mixed rock sources

Slope range: 2 to 45 percent

Elevation range: 6,100 to 8,000

Annual precipitation: 15 to 19 inches

Annual air temperature: 34 to 38 degrees F

Frost-free period: 50 to 70 days

Taxonomic Class: Fine, mixed, superactive Ustic Argicryolls

Typical Pedon

Bridger cobbly clay loam, 8 to 35 percent slopes, in an area of rangeland, 500 feet south and 400 feet west of the northeast corner of sec. 14, T. 10 S., R. 5 W. Madison County, Montana.

A—0 to 4 inches; grayish brown (10YR 5/2) cobbly clay loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable, slightly sticky, slightly plastic; many very fine and fine roots; 10 percent cobbles; 10 percent gravel; neutral; clear wavy boundary.

Bt1—4 to 7 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate medium subangular blocky structure; slightly hard, friable, moderately sticky, moderately plastic; many very fine and fine roots; common moderately

thick dark grayish brown (10YR 4/2) clay films on faces of peds and coating some pores; 5 percent cobbles and 5 percent gravel; neutral; abrupt wavy boundary.

Bt2—7 to 17 inches; light yellowish brown (10YR 6/4) clay, yellowish brown (10YR 5/4) moist; moderate medium subangular blocky structure; slightly hard, friable, moderately sticky, moderately plastic; many very fine and fine roots; common moderately thick dark grayish brown (10YR 4/4) clay films on faces of peds and coating pores; 5 percent gravel; neutral; clear wavy boundary.

Btk—17 to 21 inches; light yellowish brown (10YR 6/4) gravelly clay loam, yellowish brown (10YR 5/4) moist; weak fine prismatic structure parting to strong fine angular blocky; hard, firm, moderately sticky, moderately plastic; many very fine and fine roots between peds and few very fine and fine roots within peds; common moderately thick clay films on faces of peds and coating some pores; 30 percent gravel; strongly effervescent; mildly alkaline; clear wavy boundary.

Bk1—21 to 29 inches; very pale brown (10YR 7/3) very gravelly sandy clay loam, light yellowish brown (10YR 6/4) moist; massive; slightly hard, friable, slightly sticky, slightly plastic; few fine and common very fine roots; 40 percent gravel; violently effervescent; moderately alkaline; abrupt wavy boundary.

Bk2—29 to 60 inches; very pale brown (10YR 7/3) very gravelly sandy clay loam, brown (10YR 5/3) moist; massive; soft, very friable, slightly sticky, slightly plastic; few very fine and fine roots; 50 percent gravel; violently effervescent; moderately alkaline.

Range in Characteristics

Mean annual soil temperature: 36 to 40 degrees F

Moisture control section: Between 4 and 12 inches

Thickness of the mollic epipedon: 7 to 16 inches

Depth to the Bk horizon: 17 to 40 inches

A horizon

Value: 3 to 5 dry; 2 or 3 moist

Chroma: 1 or 2

Texture: Loam or clay loam

Clay content: 18 to 35 percent

Content of rock fragments: 5 to 35 percent—0 to 10 percent cobbles; 5 to 25 percent gravel

Reaction: pH 6.1 to 7.8

Bt horizons

Value: 5 or 6 dry; 3 to 5 moist

Chroma: 2 to 4

Texture: Clay loam, silty clay, or clay

Clay content: 35 to 50 percent

Content of rock fragments: 5 to 35 percent—0 to 10 percent cobbles; 5 to 25 percent gravel

Reaction: pH 6.1 to 7.8

Btk horizon

Value: 5 or 6 dry; 3 to 5 moist

Chroma: 2 to 4

Texture: Clay loam, silty clay, or clay

Clay content: 35 to 50 percent

Content of rock fragments: 5 to 35 percent—0 to 10 percent cobbles; 5 to 30 percent gravel

Reaction: pH 6.6 to 7.8

Bk horizons

Value: 6 to 8 dry; 5 to 7 moist

Chroma: 2 to 4

Texture: Clay loam, sandy clay loam, or loam

Clay content: 20 to 40 percent

Content of rock fragments: 35 to 50 percent gravel

Calcium carbonate equivalent: 5 to 15 percent

Reaction: pH 7.4 to 9.0

Brocko Series

Depth class: Deep

Drainage class: Well drained

Permeability: Moderate

Landform: Alluvial fans and terraces

Parent material: Alluvium

Slope range: 0 to 45 percent

Elevation range: 4,300 to 6,500 feet

Annual precipitation: 10 to 14 inches

Annual air temperature: 38 to 42 degrees F

Frost-free period: 90 to 105 days

Taxonomic Class: Coarse-silty, mixed, superactive, frigid Aridic Calcustepts

Typical Pedon

Brocko silt loam, in an area of Brocko silt loam, cool, 2 to 12 percent slopes, in an area of rangeland, 600 feet north and 2,000 feet east of the southwest corner of sec. 6, T. 1 S., R. 2 W. Madison County, Montana.

A—0 to 8 inches; brown (10YR 5/3) silt loam, brown (10YR 4/3) moist; moderate and strong medium granular structure; hard, friable, slightly sticky, slightly plastic; many fine roots; few very fine and fine tubular pores; strongly effervescent; moderately alkaline; abrupt smooth boundary.

Bk1—8 to 17 inches; light gray (2.5Y 7/2) silt loam, grayish brown (2.5Y 5/2) moist; moderate medium subangular blocky structure; hard, friable, slightly sticky, slightly plastic; common very fine and fine roots; common fine tubular pores; common distinct masses of lime; violently effervescent; moderately alkaline; gradual wavy boundary.

Bk2—17 to 39 inches; light gray (2.5Y 7/2) very fine sandy loam, grayish brown (2.5Y 5/2) moist; weak and moderate thin and medium platy structure; soft, very friable, slightly sticky, slightly plastic; few very fine roots; many very fine tubular pores; common distinct masses of lime; violently effervescent; moderately alkaline; gradual wavy boundary.

C1—39 to 48 inches; very pale brown (10YR 7/3) very fine sandy loam, pale brown (10YR 6/3) moist; massive; slightly hard, friable, slightly sticky, slightly plastic; disseminated lime; violently effervescent; moderately alkaline; gradual wavy boundary.

C2—48 to 60 inches; light gray (10YR 7/2) very fine sandy loam, pale brown (10YR 6/3) moist; massive; slightly hard, friable, slightly sticky, slightly plastic; few very fine tubular pores; 5 percent gravel; violently effervescent; moderately alkaline.

Range in Characteristics

Mean annual soil temperature: 40 to 47 degrees F

Moisture control section: Between 4 and 12 inches; dry in all parts between four-

tenths and five-tenths of the cumulative days per year when the soil temperature at a depth of 20 inches is 41 degrees F or higher

Depth to the calcic horizon: 5 to 8 inches

A horizon

Hue: 10YR, 2.5Y, or 5Y

Value: 5 to 7 dry; 4 to 6 moist

Chroma: 2 or 3

Clay content: 10 to 18 percent

Reaction: pH 7.4 to 8.4

Bk horizons

Hue: 10YR, 2.5Y, or 5Y

Value: 6 to 8 dry; 4 to 6 moist

Chroma: 2 or 3

Texture: Silt loam, very fine sandy loam, or loam

Clay content: 10 to 18 percent with less than 15 percent fine sand and coarser

Calcium carbonate equivalent: 15 to 20 percent

Reaction: pH 7.9 to 8.4

C horizons

Hue: 10YR, 2.5Y, or 5Y

Value: 6 to 8 dry; 4 to 6 moist

Chroma: 2 or 3

Texture: Silt loam or very fine sandy loam

Clay content: 10 to 18 percent with less than 15 percent fine and coarser sand

Content of rock fragments: 0 to 5 percent gravel

Reaction: pH 7.9 to 9.0

Brockway Series

Depth class: Very deep

Drainage class: Well drained

Permeability: Moderately slow

Landform: Alluvial fans

Parent material: Calcareous alluvium

Slope range: 0 to 4 percent

Elevation range: 5,000 to 5,400 feet

Annual precipitation: 10 to 14 inches

Annual air temperature: 38 to 42 degrees F

Frost-free period: 90 to 105 days

Taxonomic Class: Fine-silty, mixed, superactive, frigid Aridic Calcustepts

Typical Pedon

Brockway silt loam, 0 to 4 percent slopes, in an area of cropland, 2,000 feet west and 2,300 feet north of the southeast corner of sec. 5, T. 8 S., R. 9 W. Dillon West topographic quadrangle (lat. 45°09'57"N; long. 112°43'48"W)

Ap—0 to 5 inches; grayish brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) moist; moderate medium and coarse granular structure; hard, very friable, moderately sticky, moderately plastic; many fine, medium, and coarse roots; strongly effervescent; slightly alkaline; abrupt smooth boundary.

Bk1—5 to 14 inches; light yellowish brown (2.5Y 6/3) silt loam, olive brown (2.5Y 4/3) moist; moderate fine and medium subangular blocky structure; very hard, very friable, moderately sticky, moderately plastic; many fine, medium, and coarse

roots; common fine and medium soft masses of lime; strongly effervescent; moderately alkaline; clear wavy boundary.

Bk2—14 to 26 inches; light yellowish brown (2.5Y 6/3) silt loam, light olive brown (2.5Y 5/3) moist; weak fine, medium, and coarse subangular blocky structure; very hard, friable, very sticky, very plastic; common fine, medium, and coarse roots; many fine and medium soft masses of lime; violently effervescent; moderately alkaline; clear wavy boundary.

Bk3—26 to 44 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; weak coarse subangular blocky structure; very hard, friable, very sticky, very plastic; common very fine and fine roots; many fine and medium soft masses of lime; violently effervescent; moderately alkaline; gradual wavy boundary.

C—44 to 60 inches; light yellowish brown (10YR 6/4) silt loam, yellowish brown (10YR 5/4) moist; massive; very hard, friable, moderately sticky, moderately plastic; few fine, medium, and coarse roots; disseminated lime; violently effervescent; moderately alkaline.

Range in Characteristics

Mean annual soil temperature: 42 to 47 degrees F

Moisture control section: Between 4 and 12 inches; dry in all parts between four-tenths and five-tenths of the cumulative days per year when the soil temperature at a depth of 20 inches is 41 degrees F or higher

Depth to the Bk horizon: 4 to 10 inches

Ap horizon

Hue: 10YR or 2.5Y

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 or 3

Texture: Silt loam, silty clay loam, or loam

Clay content: 18 to 27 percent

Calcium carbonate equivalent: 5 to 10 percent

Reaction: pH 7.4 to 8.4

Bk1 horizon

Hue: 10YR or 2.5Y

Value: 6 or 7 dry; 4 or 5 moist

Chroma: 2 to 4

Clay content: 18 to 27 percent

Calcium carbonate equivalent: 5 to 15 percent

Reaction: pH 7.4 to 8.4

Bk2 and Bk3 horizons

Hue: 10YR or 2.5Y

Value: 6 to 8 dry; 4 to 6 moist

Chroma: 2 to 4

Texture: Silt loam or silty clay loam

Clay content: 18 to 35 percent

Calcium carbonate equivalent: 15 to 40 percent

Reaction: pH 7.9 to 8.4

C horizon

Hue: 10YR or 2.5Y

Value: 6 or 7 dry; 5 or 6 moist

Chroma: 2 to 4

Texture: Silt loam or silty clay loam

Clay content: 18 to 35 percent

Calcium carbonate equivalent: 15 to 25 percent

Reaction: pH 7.9 to 8.4

Bronec Series

Depth class: Very deep

Drainage class: Well drained

Permeability: Moderate

Landform: Hills, escarpments, fans, and terraces

Parent material: Calcareous alluvium, glacial till, hills, and escarpments

Slope range: 0 to 60 percent

Elevation range: 4,500 to 6,500 feet

Annual precipitation: 10 to 14 inches

Annual air temperature: 38 to 42 degrees F

Frost-free period: 70 to 105 days

Taxonomic Class: Loamy-skeletal, mixed, superactive, frigid Aridic Calcustepts

Typical Pedon

Bronec gravelly sandy loam, in an area of Bronec-Kalsted gravelly sandy loams, 2 to 8 percent slopes, in an area of rangeland, 2,100 feet south and 2,650 feet east of the northwest corner of sec. 26, T. 5 S., R. 9 W. Bond topographic quadrangle (lat. 45°22'23"N; long. 112°40'52"W)

- A—0 to 5 inches; light brownish gray (10YR 6/2) gravelly sandy loam, brown (10YR 4/3) moist; weak fine and medium subangular blocky structure parting to weak very fine and fine granular; soft, very friable, slightly sticky, slightly plastic; few fine and many very fine roots; 25 percent gravel; strongly effervescent; slightly alkaline; clear smooth boundary.
- Bk1—5 to 17 inches; very pale brown (10YR 7/4) very gravelly sandy loam, yellowish brown (10YR 5/4) moist; weak fine and medium subangular blocky structure parting to weak very fine and fine subangular blocky; soft, very friable, slightly sticky, slightly plastic; few fine and many very fine roots; 10 percent cobbles; 30 percent gravel; common fine and medium soft masses of lime; common distinct carbonate coats on gravel; violently effervescent; slightly alkaline; clear smooth boundary.
- Bk2—17 to 31 inches; very pale brown (10YR 7/4) very gravelly sandy loam, light yellowish brown (10YR 6/4) moist; weak very fine and fine subangular blocky structure; soft, very friable, slightly sticky, slightly plastic; few very fine roots; 15 percent cobbles; 40 percent gravel; common fine and medium soft masses of lime; common distinct carbonate coats on gravel; violently effervescent; moderately alkaline; clear smooth boundary.
- Bk3—31 to 60 inches; light yellowish brown (10YR 6/4) extremely gravelly sandy loam, yellowish brown (10YR 5/4) moist; weak very fine and fine subangular blocky structure; soft, very friable, slightly sticky, slightly plastic; few very fine roots; 20 percent cobbles; 45 percent gravel; disseminated lime; continuous distinct lime casts on undersides of rock fragments; strongly effervescent; moderately alkaline.

Range in Characteristics

Mean annual soil temperature: 40 to 46 degrees F

Moisture control section: Between 4 and 12 inches; dry in all parts between four-tenths and five-tenths of the cumulative days per year when the soil temperature at a depth of 20 inches is 41 degrees F or higher

Depth to the Bk horizon: 2 to 6 inches

A horizon

Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 3 or 4 moist
Chroma: 2 to 4
Texture: Loam, sandy loam, or fine sandy loam
Clay content: 5 to 25 percent
Content of rock fragments: 10 to 60 percent—0 to 20 percent stones or cobbles;
10 to 40 percent gravel
Reaction: pH 6.6 to 8.4

Bk1 horizon

Hue: 10YR or 2.5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Loam or sandy loam
Clay content: 15 to 27 percent
Content of rock fragments: 15 to 60 percent—0 to 10 percent stones or cobbles;
15 to 50 percent gravel
Calcium carbonate equivalent: 3 to 15 percent
Electrical conductivity: 0 to 4 mmhos/cm
Reaction: pH 7.4 to 8.4

Bk2 horizon

Hue: 10YR or 2.5Y
Value: 5 to 8 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Loam or sandy loam
Clay content: 15 to 27 percent
Content of rock fragments: 20 to 60 percent—0 to 20 percent stones or cobbles;
20 to 50 percent gravel
Calcium carbonate equivalent: 15 to 40 percent
Electrical conductivity: 0 to 4 mmhos/cm
Reaction: pH 7.9 to 9.0

Bk3 horizon

Hue: 10YR or 2.5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Loam or sandy loam
Clay content: 15 to 25 percent
Content of rock fragments: 35 to 65 percent—0 to 25 percent stones or cobbles;
25 to 50 percent gravel
Calcium carbonate equivalent: 5 to 25 percent
Electrical conductivity: 0 to 4 mmhos/cm
Reaction: pH 7.4 to 8.4

Cabbart Series

Depth class: Shallow

Drainage class: Well drained

Permeability: Moderate

Landform: Escarpments, hillsides, strike ridges, and hogbacks

Parent material: Residuum from semiconsolidated loamy sedimentary beds

Slope range: 4 to 60 percent

Elevation range: 4,500 to 6,500 feet

Annual precipitation: 10 to 14 inches

Annual air temperature: 38 to 42 degrees F

Frost-free period: 70 to 105 days

Taxonomic Class: Loamy, mixed, superactive, calcareous, frigid, shallow Aridic Ustorthents

Typical Pedon

Cabbart cobbly loam, in an area of Kalsted-Scravo, stony-Cabbart complex, 15 to 45 percent slopes, in an area of rangeland, 2,450 feet north and 1,500 feet east of the southwest corner of sec. 28, T. 7 S., R. 8 W. Dillon East topographic quadrangle (lat. 45°11'45"N; long. 112°35'41"W)

A—0 to 3 inches; pale brown (10YR 6/3) cobbly loam, brown (10YR 5/3) moist; weak fine and medium subangular blocky structure parting to weak very fine and fine granular; slightly hard, friable, slightly sticky, slightly plastic; few fine and many very fine roots; 10 percent cobbles; 5 percent gravel; strongly effervescent; moderately alkaline; clear wavy boundary.

Bk—3 to 16 inches; very pale brown (10YR 7/3) gravelly loam, light yellowish brown (10YR 6/4) moist; weak fine and medium subangular blocky structure parting to weak very fine and fine granular; slightly hard, friable, slightly sticky, slightly plastic; few fine and common very fine roots; 30 percent gravel; disseminated lime; few fine soft masses of lime; violently effervescent; moderately alkaline; clear wavy boundary.

Cr—16 to 60 inches; semiconsolidated loamy sedimentary beds.

Range in Characteristics

Mean annual soil temperature: 40 to 47 degrees F

Moisture control section: Between 4 and 12 inches or to the paralithic contact; dry in all parts between four-tenths and five-tenths of the cumulative days per year when the soil temperature at a depth of 20 inches is 41 degrees F or higher

Depth to the Cr horizon: 10 to 20 inches

Surface stones: 0 to 3 percent

A horizon

Value: 5 to 7 dry; 3 to 5 moist

Chroma: 2 to 4

Texture: Sandy loam, silt loam, or loam

Clay content: 10 to 25 percent

Content of rock fragments: 0 to 60 percent—0 to 20 percent cobbles; 0 to 50 percent gravel

Electrical conductivity: 0 to 4 mmhos/cm

Calcium carbonate equivalent: 1 to 10 percent

Reaction: pH 7.4 to 9.0

Bk horizon

Hue: 10YR or 2.5Y

Value: 6 or 7 dry; 4 to 6 moist

Chroma: 2 to 4

Texture: Loam or silt loam

Clay content: 18 to 25 percent

Content of rock fragments: 0 to 45 percent—0 to 15 percent hard gravel; 0 to 45 percent soft gravel

Electrical conductivity: 0 to 8 mmhos/cm

Sodium adsorption ratio: 0 to 10

Calcium carbonate equivalent: 10 to 25 percent

Reaction: pH 7.4 to 9.0

Cheadle Family

Depth class: Shallow

Drainage class: Well drained

Permeability: Moderate

Landform: Hillsides, ridges, strike ridges, and mountain slopes

Parent material: Gneiss, schist, and marble

Slope range: 15 to 60 percent

Elevation range: 6,100 to 7,200 feet

Annual precipitation: 15 to 19 inches

Annual air temperature: 38 to 42 degrees F

Frost-free period: 30 to 70 days

Taxonomic Class: Loamy-skeletal, mixed, superactive Lithic Haplocryolls

Typical Pedon

Cheadle family very gravelly loam, in an area of Cheadle family, very stony-Rock outcrop complex, 25 to 60 percent slopes, in an area of rangeland, 1,500 feet west and 1,400 feet south of the northeast corner of sec. 26, T. 8 S., R. 8 W. Ashbough Canyon topographic quadrangle (lat. 45°06'44"N; long. 112°32'46"W)

A—0 to 5 inches; grayish brown (10YR 5/2) very gravelly loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable, nonsticky, nonplastic; few medium and many very fine and fine roots; 5 percent cobbles; 30 percent gravel; disseminated lime; strongly effervescent; slightly alkaline; clear smooth boundary.

Bk—5 to 12 inches; pale brown (10YR 6/3) very gravelly sandy loam, brown (10YR 4/3) moist; weak fine subangular blocky structure; soft, very friable, nonsticky, nonplastic; few medium and many very fine and fine roots; 5 percent cobbles; 35 percent gravel; disseminated lime; continuous prominent carbonate coats on undersides of rock fragments; violently effervescent; moderately alkaline; gradual smooth boundary.

C—12 to 19 inches; pale brown (10YR 6/3) very gravelly coarse sand, brown (10YR 5/3) moist; single grain; loose; few very fine, fine, and medium roots; 5 percent cobbles; 35 percent gravel; disseminated lime; strongly effervescent; moderately alkaline.

R—19 inches; fractured gneiss bedrock.

Range in Characteristics

Mean annual soil temperature: 36 to 40 degrees F

Moisture control section: Between 4 and 12 inches or between 4 inches and the lithic contact when bedrock is less than 12 inches

Thickness of the mollic epipedon: 7 to 10 inches

Depth to the lithic contact: 10 to 20 inches

Surface stones and boulders: 0.1 to 3 percent

A horizon

Hue: 10YR or 2.5Y

Value: 4 or 5 dry; 2 or 3 moist

Chroma: 2 or 3

Clay content: 10 to 18 percent

Content of rock fragments: 15 to 50 percent—0 to 10 percent cobbles; 15 to 40 percent gravel

Calcium carbonate equivalent: 0 to 5 percent

Reaction: pH 6.6 to 8.4

Bk horizon

Hue: 10YR or 2.5Y

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 to 4

Texture: Loam or sandy loam

Clay content: 10 to 18 percent

Content of rock fragments: 35 to 75 percent—0 to 15 percent cobbles; 35 to 50 percent gravel

Calcium carbonate equivalent: 5 to 15 percent

Reaction: pH 7.4 to 8.4

C horizon

Hue: 10YR or 2.5Y

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 to 4

Texture: Coarse sandy loam or coarse sand

Clay content: 4 to 12 percent

Content of rock fragments: 35 to 75 percent—0 to 15 percent cobbles; 35 to 50 percent gravel

Calcium carbonate equivalent: 0 to 10 percent

Reaction: pH 7.4 to 8.4

Chinook Series

Depth class: Very deep

Drainage class: Well drained

Permeability: Moderately rapid

Landform: Alluvial fans and stream terraces

Parent material: Alluvium

Slope range: 2 to 8 percent

Elevation range: 5,000 to 6,000 feet

Annual precipitation: 10 to 14 inches

Annual air temperature: 39 to 42 degrees F

Frost-free period: 90 to 105 days

Taxonomic Class: Coarse-loamy, mixed, superactive, frigid Aridic Haplustolls

Typical Pedon

Chinook sandy loam, in an area of Chinook-Glendive sandy loams, 0 to 8 percent slopes, in an area of pastureland, 400 feet south and 650 feet east of the northwest corner of sec. 1, T. 8 S., R. 8 W. Dillon East topographic quadrangle (lat. 45°10'25"N; long. 112°32'10"W)

Ap—0 to 6 inches; grayish brown (10YR 5/2) sandy loam, dark brown (10YR 3/3) moist; weak fine and medium subangular blocky structure parting to weak very fine and fine granular; soft, very friable, slightly sticky, nonplastic; few fine and many very fine roots; slightly alkaline; clear smooth boundary.

Bw—6 to 13 inches; brown (10YR 5/3) sandy loam, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to moderate fine and medium

subangular blocky; slightly hard, very friable, slightly sticky, nonplastic; few fine and common very fine roots; neutral; clear smooth boundary.

Bk1—13 to 22 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 4/3) moist; weak fine and medium subangular blocky structure parting to weak very fine and fine granular; soft, very friable, slightly sticky, nonplastic; few fine and common very fine roots; 5 percent gravel; disseminated lime; strongly effervescent; slightly alkaline; clear smooth boundary.

Bk2—22 to 46 inches; light yellowish brown (10YR 6/4) sandy loam, yellowish brown (10YR 5/4) moist; weak fine and medium subangular blocky structure parting to weak very fine and fine granular; soft, very friable, slightly sticky, nonplastic; few very fine roots; 10 percent gravel; disseminated lime; violently effervescent; slightly alkaline; clear smooth boundary.

BC—46 to 60 inches; very pale brown (10YR 7/3) gravelly loamy sand, brown (10YR 5/3) moist; single grain; loose, nonsticky, nonplastic; 15 percent gravel; disseminated lime; strongly effervescent; moderately alkaline.

Range in Characteristics

Mean annual soil temperature: 40 to 47 degrees F

Moisture control section: Between 8 and 24 inches

Thickness of the mollic epipedon: 7 to 15 inches

Depth to the Bk horizon: 10 to 15 inches

Ap horizon

Hue: 10YR or 2.5Y

Value: 2 or 3 moist

Chroma: 2 or 3

Texture: Fine sandy loam or sandy loam

Clay content: 10 to 18 percent

Content of rock fragments: 0 to 35 percent gravel

Reaction: pH 6.6 to 7.8

Bw horizon

Hue: 10YR or 2.5Y

Value: 5 or 6 dry; 3 or 4 moist

Chroma: 3 or 4

Texture: Fine sandy loam or sandy loam

Clay content: 10 to 18 percent

Content of rock fragments: 0 to 15 percent gravel

Reaction: pH 6.6 to 8.4

Bk horizons

Value: 6 or 7 dry; 4 or 5 moist

Chroma: 2 to 4

Texture: Fine sandy loam or sandy loam

Clay content: 10 to 18 percent

Content of rock fragments: 0 to 15 percent gravel

Calcium carbonate equivalent: 5 to 15 percent

Reaction: pH 7.4 to 8.4

BC horizon

Value: 6 or 7 dry; 5 moist

Chroma: 3 or 4

Texture: Loamy sand or sandy loam

Clay content: 5 to 15 percent

Content of rock fragments: 0 to 15 percent gravel

Reaction: pH 7.4 to 8.4

Crago Series

Depth class: Very deep

Drainage class: Well drained

Permeability: Moderate

Landform: Alluvial fans, stream terraces, drainageways, escarpments, and hills

Parent material: Alluvium from limestone

Slope range: 0 to 60 percent

Elevation range: 4,800 to 6,500 feet

Annual precipitation: 10 to 14 inches

Annual air temperature: 38 to 42 degrees F

Frost-free period: 70 to 105 days

Taxonomic Class: Loamy-skeletal, carbonatic, frigid Aridic Calcustepts

Typical Pedon

Crago gravelly loam in an area of Crago complex, 4 to 10 percent slopes, in an area of rangeland, 900 feet west and 2,200 feet south of the northeast corner of sec. 22, T. 9 S., R. 8 W. Ashbough Canyon topographic quadrangle (lat. 45°02'13"N; long. 112°33'40"W)

- A—0 to 3 inches; grayish brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak very fine and fine granular structure; soft, very friable, slightly sticky, nonplastic; many very fine and fine roots; 5 percent cobbles; 15 percent gravel; slightly effervescent; moderately alkaline; clear smooth boundary.
- Bk1—3 to 8 inches; pale brown (10YR 6/3) gravelly loam, brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine and fine roots; 5 percent cobbles; 20 percent gravel; violently effervescent; moderately alkaline; clear smooth boundary.
- Bk2—8 to 18 inches; very pale brown (10YR 7/3) very gravelly loam, brown (10YR 5/3) moist; weak medium and coarse subangular blocky structure; hard, friable, moderately sticky, moderately plastic; common fine roots; 5 percent cobbles; 35 percent gravel; violently effervescent; moderately alkaline; gradual wavy boundary.
- Bk3—18 to 34 inches; pale yellow (2.5Y 7/4) extremely gravelly loam, light yellowish brown (2.5Y 6/4) moist; weak coarse subangular blocky structure; hard, friable, moderately sticky, moderately plastic; few very fine and fine roots; 10 percent cobbles; 55 percent gravel; violently effervescent; moderately alkaline; clear wavy boundary.
- Bk4—34 to 60 inches; very pale brown (10YR 7/4) extremely gravelly sandy loam, light yellowish brown (10YR 6/4) moist; weak coarse subangular blocky structure; slightly hard, very friable, slightly sticky, nonplastic; 15 percent cobbles; 60 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Mean annual soil temperature: 40 to 47 degrees F

Moisture control section: Between 4 and 12 inches; dry in all parts between four-tenths and five-tenths of the cumulative days per year when the soil temperature at a depth of 20 inches is 41 degrees F or higher

Surface stones: 0 to 3 percent

Note: The surface horizon, when mixed to 7 inches, does not meet the requirements of a mollic epipedon.

A horizon

Hue: 10YR or 2.5Y
Value: 4 to 6 dry; 3 to 5 moist
Chroma: 2 or 3
Texture: Loam or sandy loam
Clay content: 15 to 25 percent
Content of rock fragments: 0 to 60 percent—0 to 30 percent cobbles; 0 to 45 percent gravel
Reaction: pH 7.9 to 8.4

Bk1 horizon

Hue: 10YR or 2.5Y
Value: 5 to 8 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Loam or sandy loam
Clay content: 15 to 25 percent
Content of rock fragments: 15 to 60 percent—0 to 30 percent cobbles; 15 to 60 percent gravel
Calcium carbonate equivalent: 5 to 15 percent in the fine earth fraction, 40 percent in the whole soil including rock fragments less than 3/4 inch in size
Reaction: pH 7.9 to 8.4

Bk2 and Bk3 horizons

Hue: 10YR or 2.5Y
Value: 6 to 8 dry; 4 to 7 moist
Chroma: 2 to 4
Texture: Loam or sandy loam
Clay content: 15 to 25 percent
Content of rock fragments: 35 to 75 percent—0 to 30 percent cobbles; 35 to 60 percent gravel
Calcium carbonate equivalent: 15 to 30 percent for the fine earth fraction and the whole soil including rock fragments less than 3/4 inch in size is 40 to 70 percent
Reaction: pH 7.9 to 8.4

Bk4 horizon

Hue: 10YR or 2.5Y
Value: 6 to 8 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Sandy loam or loam
Clay content: 15 to 25 percent
Content of rock fragments: 40 to 80 percent—0 to 20 percent cobbles; 40 to 60 percent gravel
Calcium carbonate equivalent: 15 to 30 percent for the fine earth fraction; the whole soil, including rock fragments less than 3/4 inch in size, is 40 to 70 percent
Reaction: pH 7.9 to 8.4

Delpoint Series

Depth class: Moderately deep

Drainage class: Well drained

Permeability: Moderate

Landform: Hillsides

Parent material: Alluvium over residuum derived from loamy sedimentary beds

Slope range: 4 to 35 percent
Elevation range: 4,500 to 6,500 feet
Annual precipitation: 10 to 14 inches
Annual air temperature: 38 to 42 degrees F
Frost-free period: 70 to 105 days

Taxonomic Class: Fine-loamy, mixed, superactive, frigid Aridic Haplustepts

Typical Pedon

Delpoint clay loam, in an area of Sappington-Geohrock-Delpoint, stony complex, 4 to 25 percent slopes, in an area of rangeland, 1,550 feet south and 2,150 feet west of the northeast corner of sec. 13, T. 5 S., R. 9 W. Glen topographic quadrangle (lat. 45°24'14"N; long. 112°39'31"W)

- A—0 to 4 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; weak fine and medium subangular blocky structure parting to weak very fine and fine granular; soft, very friable, moderately sticky, slightly plastic; few fine and many very fine roots; 5 percent gravel; strongly effervescent; slightly alkaline; clear smooth boundary.
- Bw—4 to 18 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; moderate coarse subangular blocky structure parting to moderate fine and medium subangular blocky; slightly hard, friable, moderately sticky, slightly plastic; few fine and common very fine roots; disseminated lime; common fine irregular soft masses of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.
- Bk—18 to 27 inches; pale yellow (2.5Y 7/3) sandy loam, light yellowish brown (2.5Y 6/3) moist; weak fine and medium subangular blocky structure parting to weak very fine and fine granular; soft, very friable, slightly sticky, slightly plastic; few very fine roots; disseminated lime; strongly effervescent; moderately alkaline; clear smooth boundary.
- Cr1—27 to 38 inches; very soft, noncalcareous semiconsolidated sedimentary beds that rub to loamy sand; clear smooth boundary.
- Cr2—38 to 60 inches; soft, noncalcareous semiconsolidated sedimentary beds that rub to silt loam.

Range in Characteristics

Mean annual soil temperature: 40 to 46 degrees F
Moisture control section: Between 4 and 12 inches; dry in all parts between four-tenths and five-tenths of the cumulative days per year when the soil temperature at a depth of 20 inches is 41 degrees F or higher
Depth to the Bk horizon: 10 to 20 inches
Depth to the paralithic contact: 20 to 40 inches
Surface stones: 0 to 0.1 percent
Surface cobbles: 0 to 60 percent

A horizon

Hue: 10YR or 2.5Y
 Value: 5 or 6 dry; 3 to 5 moist
 Chroma: 2 to 4
 Texture: Loam, clay loam, silt loam, or very fine sandy loam
 Clay content: 10 to 35 percent
 Content of rock fragments: 0 to 15 percent gravel
 Effervescence: None to strongly
 Reaction: pH 6.6 to 8.4

Bw horizon

Hue: 10YR, 2.5Y, or 5Y
 Value: 5 to 7 dry; 4 or 5 moist
 Chroma: 2 to 4
 Texture: Loam, clay loam, or silty clay loam
 Clay content: 18 to 35 percent
 Content of rock fragments: 0 to 15 percent gravel
 Effervescence: Strongly to violently
 Reaction: pH 7.7 to 8.4

Bk horizon

Hue: 10YR or 2.5Y
 Value: 5 to 7 dry; 4 to 6 moist
 Chroma: 2 to 4
 Texture: Loam, sandy loam, clay loam, or silty clay loam
 Clay content: 18 to 35 percent
 Content of rock fragments: 0 to 15 percent gravel
 Calcium carbonate equivalent: 5 to 30 percent
 Reaction: pH 7.7 to 8.3

Dillon Series

Depth class: Very deep
Drainage class: Somewhat poorly drained
Permeability: Moderate to 31 inches and rapid below
Landform: Flood plains and stream terraces
Parent material: Alluvium
Slope range: 0 to 4 percent
Elevation range: 4,500 to 6,500 feet
Annual precipitation: 10 to 14 inches
Annual air temperature: 36 to 41 degrees F
Frost-free period: 70 to 105 days

Taxonomic Class: Fine-loamy over sandy or sandy-skeletal, mixed, superactive, frigid Oxyaquic Haplustepts

Typical Pedon

Dillon silt loam, 0 to 2 percent slopes, in an area of cropland, 850 feet south and 2,450 feet west of the northeast corner of sec. 24, T. 7 S., R. 9 W. Dillon West topographic quadrangle (lat. 45°12'55"N; long. 112°39'00"W)

- Ap—0 to 4 inches; gray (2.5Y 5/1) silt loam, very dark grayish brown (2.5Y 3/2) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, moderately sticky, slightly plastic; few fine and many very fine roots; few fine and many very fine interstitial pores; disseminated lime; strongly effervescent; slightly alkaline; clear smooth boundary.
- Bw—4 to 11 inches; gray (2.5Y 6/1) silt loam, dark gray (2.5Y 4/1) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, moderately sticky, slightly plastic; few fine and many very fine roots; few fine and many very fine tubular and interstitial pores; disseminated lime; strongly effervescent; slightly alkaline; clear smooth boundary.
- BC—11 to 31 inches; light gray (2.5Y 7/1) loam, gray (2.5Y 6/1) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; few fine and many very fine roots; few fine and common very fine

tubular and interstitial pores; disseminated lime; violently effervescent; moderately alkaline; clear smooth boundary.

2C1—31 to 36 inches; light gray (5Y 7/1) loamy sand, gray (5Y 6/1) moist; common fine and medium distinct (7.5YR 4/4) moist redox concentrations; single grain; loose, nonsticky, nonplastic; disseminated lime; strongly effervescent; moderately alkaline; clear smooth boundary.

2C2—36 to 60 inches; light gray (5Y 7/1) very gravelly sand, gray (5Y 6/1) moist; single grain; loose, nonsticky, nonplastic; 10 percent cobbles; 40 percent gravel; slightly effervescent; slightly alkaline.

Range in Characteristics

Mean annual soil temperature: 42 to 46 degrees F; frigid soil temperature regime

Moisture control section: Between 4 and 12 inches; ustic soil moisture regime

Depth to the 2C horizon: 20 to 40 inches

Depth to the seasonal high water table: 24 to 42 inches

Soil phase: Saline

Note: Some pedons have a thin (<3 inches) Oe horizon.

Ap horizon

Hue: 10YR or 2.5Y

Value: 5 or 6 dry; 3 to 5 moist

Chroma: 1 to 3

Texture: Silt loam, loam, clay loam, silty clay loam, or sandy clay loam

Clay content: 18 to 35 percent

Content of rock fragments: 0 to 10 percent gravel

Calcium carbonate equivalent: 10 to 30 percent

Electrical conductivity: 0 to <4 (saline phase 4 to 16)

Reaction: pH 7.6 to 8.6 (saline phase pH 7.9 to 9.0)

Bw horizon

Hue: 10YR or 2.5Y

Value: 5 to 7 dry; 4 to 6 moist

Chroma: 1 to 3

Texture: Silt loam, loam, clay loam, sandy clay loam, or silty clay loam

Clay content: 18 to 35 percent

Content of rock fragments: 0 to 10 percent gravel

Calcium carbonate equivalent: 10 to 30 percent

Electrical conductivity: 0 to <4 (saline phase 4 to 16)

Reaction: pH 7.6 to 8.6 (saline phase pH 7.9 to 9.2)

BC horizon

Hue: 10YR or 2.5Y

Value: 5 to 7 dry; 4 to 6 moist

Chroma: 1 to 3

Texture: Loam, sandy loam, sandy clay loam, silt loam, or silty clay loam

Clay content: 18 to 30 percent

Content of rock fragments: 0 to 10 percent gravel

Calcium carbonate equivalent: 10 to 30 percent

Electrical conductivity: 0 to <4 (saline phase 2 to 25)

Reaction: pH 7.6 to 8.6 (saline phase pH 8.5 to 9.0)

2C1 horizon

Hue: 2.5Y or 5Y

Value: 5 to 7 dry; 4 to 6 moist

Chroma: 1 to 3

Texture: Loamy sand, loamy coarse sand, sand, or coarse sand

Clay content: 0 to 10 percent
 Content of rock fragments: 0 to 35 percent gravel
 Calcium carbonate equivalent: 5 to 20 percent
 Electrical conductivity: 0 to <4 (saline phase 4 to 16)
 Reaction: pH 7.4 to 8.4 (saline phase pH 8.5 to 9.0)

2C2 horizon

Hue: 5Y, 10Y, or N
 Value: 5 to 7 dry; 4 to 6 moist
 Chroma: 1 to 3
 Texture: Loamy sand, loamy coarse sand, sand, or coarse sand
 Clay content: 0 to 10 percent
 Content of rock fragments: 35 to 80 percent—0 to 30 percent cobbles; 35 to 50 percent gravel
 Reaction: pH 7.4 to 8.4

Dougcliff Series

Depth class: Very deep
Drainage class: Very poorly drained
Permeability: Moderately rapid
Landform: Marshes
Parent material: Fibrous material derived mainly from herbaceous vegetation
Slope range: 0 to 1 percent
Elevation range: 5,800 to 6,200 feet
Annual precipitation: 10 to 14 inches
Annual air temperature: 36 to 42 degrees F
Frost-free period: 70 to 90 days

Taxonomic Class: Euic, frigid Typic Haplofibrists

Typical Pedon

Dougcliff peat in an area of Newtman-Dougcliff complex, 0 to 4 percent slopes, in an area of wetland, 100 feet east and 2,000 feet north of the southwest corner of sec. 1, T. 10 S., R. 7 W. Price Creek topographic quadrangle (lat. 44°59'27"N; long. 112°24'58"W)

- Oi1—0 to 12 inches; very dark gray (10YR 3/1) and very dark gray (10YR 3/1) rubbed and pressed peat; 90 percent fiber and raw herbaceous plant material; 75 percent rubbed; massive; nonsticky, nonplastic; disseminated lime; slightly effervescent; slightly alkaline; clear wavy boundary.
- Oi2—12 to 28 inches; very dark gray (7.5YR 3/1) and very dark gray (7.5YR 3/1) rubbed and pressed peat; 85 percent fiber; 75 percent rubbed; massive; nonsticky, nonplastic; neutral; gradual wavy boundary.
- Oi3—28 to 46 inches; dark brown (7.5YR 3/2) and dark brown (7.5YR 3/2) rubbed and pressed peat; 80 percent fiber; 75 percent rubbed; massive; nonsticky, nonplastic; neutral; clear wavy boundary.
- Oe—46 to 60 inches; very dark grayish brown (10YR 3/2) and very dark grayish brown (10YR 3/2) rubbed and pressed mucky peat; 75 percent fiber; 60 percent rubbed; massive; nonsticky, nonplastic; neutral.

Range in Characteristics

Mean annual soil temperature: 38 to 47 degrees F
Depth of organic material: >51 inches

Depth to the seasonal high water table: 0 to 6 inches

Note: Some pedons have a thin (<3 inches) Oe horizon.

Oi1 horizon

Hue: 7.5YR or 10YR

Value: 2 or 3 moist

Chroma: 1 or 2

Texture: Peat or mucky peat

Fiber content: 80 to 90 percent unrubbed; 65 to 75 percent rubbed

Reaction: pH 6.1 to 7.8

Oi2 horizon

Hue: 7.5YR or 10YR

Value: 2 or 3 moist

Chroma: 1 or 2

Fiber content: 85 to 95 percent unrubbed; 75 to 85 percent rubbed

Reaction: pH 6.1 to 7.8

Oi3 horizon

Hue: 7.5YR or 10YR

Value: 2 or 3 moist

Fiber content: 80 to 90 percent unrubbed; 70 to 80 percent rubbed

Reaction: pH 6.6 to 7.8

Oe horizon

Hue: 7.5YR or 10YR

Value: 3 moist

Fiber content: 75 to 85 percent unrubbed; 60 to 75 percent rubbed

Reaction: pH 6.1 to 7.8

Elve Series

Depth class: Very deep

Drainage class: Somewhat excessively drained

Permeability: Moderately rapid

Landform: Mountain slopes

Parent material: Colluvium and alluvium, mainly from fine-grained igneous rocks

Slope range: 20 to 60 percent

Elevation range: 5,500 to 7,800 feet

Annual precipitation: 15 to 28 inches

Annual air temperature: 36 to 40 degrees F

Frost-free period: 30 to 70 days

Taxonomic Class: Loamy-skeletal, mixed, superactive Ustic Eutrocrypts

Typical Pedon

Elve very cobbly loam in an area of Elve, very stony-Cowood, rubbly-Rock outcrop complex, 35 to 60 percent slopes, in an area of forestland, 50 feet west and 1,500 feet south of the northeast corner of sec. 11, T. 4 N., R. 4 W. Jefferson County, Montana.

Oi—0 to 1 inch; forest litter of partially decomposed needles, twigs, and cones.

A1—1 to 3 inches; dark grayish brown (10YR 4/2) very cobbly loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure; slightly hard, very friable, nonsticky, nonplastic; many medium and coarse roots; many very fine and

- fine tubular pores; 20 percent angular cobbles; 20 percent angular gravel; moderately acid; clear wavy boundary.
- A2—3 to 6 inches; brown (10YR 5/3) very cobbly loam, dark brown (10YR 3/3) moist; moderate medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; many medium and coarse roots; many very fine and fine tubular pores; 25 percent angular cobbles; 20 percent angular gravel; moderately acid; clear wavy boundary.
- E—6 to 12 inches; pale brown (10YR 6/3) very gravelly loam, brown (10YR 5/3) moist; weak medium and coarse subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; many fine, medium, and coarse roots; many very fine and fine tubular pores; 15 percent angular cobbles; 45 percent angular gravel; slightly acid; gradual wavy boundary.
- Bw—12 to 19 inches; light brownish gray (10YR 6/2) very gravelly loam, brown (10YR 5/3) moist; moderate medium prismatic structure; slightly hard, friable, slightly sticky, slightly plastic; common fine, medium, and coarse roots; many very fine and fine tubular pores; 15 percent angular cobbles; 40 percent angular gravel; slightly acid; gradual wavy boundary.
- BC—19 to 33 inches; pale brown (10YR 6/3) very gravelly coarse sandy loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, friable, nonsticky, nonplastic; common fine, medium, and coarse roots; many very fine and fine tubular pores; 20 percent angular cobbles; 45 percent angular gravel; slightly acid; gradual wavy boundary.
- C—33 to 60 inches; light yellowish brown (10YR 6/4) extremely gravelly coarse sandy loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, very friable, nonsticky, nonplastic; few very fine and fine roots; common fine tubular pores; 25 percent angular cobbles; 40 percent angular gravel; slightly acid.

Range in Characteristics

Mean annual soil temperature: 36 to 42 degrees F

Moisture control section: Between 4 and 12 inches

Surface stones and boulders: 0 to 20 percent

A horizons

Value: 4 to 6 dry; 2 to 4 moist

Chroma: 2 to 4

Texture: Sandy loam or loam

Clay content: 10 to 27 percent

Content of rock fragments: 5 to 60 percent—0 to 30 percent stones or cobbles; 5 to 30 percent gravel

Reaction: pH 5.1 to 6.5

E horizon

Value: 6 or 7 dry; 4 or 5 moist

Chroma: 2 to 4

Texture: Loam or sandy loam

Clay content: 10 to 20 percent

Content of rock fragments: 35 to 85 percent—0 to 25 percent stones; 10 to 40 percent cobbles; 20 to 45 percent gravel.

Reaction: pH 5.1 to 6.5

Bw horizon

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 to 4

Texture: Loam, coarse sandy loam, or sandy loam

Clay content: 10 to 20 percent

Content of rock fragments: 60 to 85 percent—15 to 40 percent stones or cobbles;
 25 to 45 percent gravel
 Reaction: pH 5.1 to 6.5

BC and C horizons

Value: 6 or 7 dry; 4 or 5 moist
 Chroma: 3, 4, or 6
 Texture: Coarse sandy loam, sandy loam, or loam
 Clay content: 10 to 20 percent
 Content of rock fragments: 60 to 85 percent—20 to 40 percent stones or cobbles;
 35 to 45 percent gravel
 Reaction: pH 5.1 to 6.5

Ermont Series

Depth class: Shallow

Drainage class: Well drained

Permeability: Moderate

Landform: Summits and shoulders on hills

Parent material: Colluvium and residuum from tuff

Slope range: 4 to 35 percent

Elevation range: 5,600 to 7,000 feet

Annual precipitation: 15 to 19 inches

Annual air temperature: 34 to 40 degrees F

Frost-free period: 30 to 70 days

Taxonomic Class: Loamy-skeletal, mixed, superactive Lithic Haplocryalfs

Typical Pedon

Ermont gravelly loam, in an area of Ermont-Rock outcrop-Ratiopeak complex, 4 to 35 percent slopes, in an area of rangeland, 2,600 feet east and 700 feet north of the southwest corner of sec. 11, T. 7 S., R. 11 W.

A—0 to 4 inches; grayish brown (10YR 5/2) gravelly loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable, slightly sticky, nonplastic; many very fine, fine, medium, and coarse roots; 5 percent cobbles; 20 percent gravel; neutral; clear smooth boundary.

Bt1—4 to 10 inches; pale brown (10YR 6/3) very gravelly loam, brown (10YR 4/3) moist; moderate medium and coarse subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; many fine and medium roots; many distinct clay films on faces of peds; 35 percent gravel; neutral; clear wavy boundary.

Bt2—10 to 15 inches; pale brown (10YR 6/3) very gravelly loam, brown (10YR 5/3) moist; weak medium and coarse subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; common fine and medium roots; many faint clay films on faces of peds; 45 percent gravel; neutral; clear wavy boundary.

BC—15 to 19 inches; pale brown (10YR 6/3) extremely gravelly loam, brown (10YR 5/3) moist; massive; soft, very friable, nonsticky, nonplastic; few fine roots; 65 percent gravel; neutral.

R—19 inches; fractured tuff bedrock; few fine roots in some cracks.

Range in Characteristics

Mean annual soil temperature: 36 to 40 degrees F

Moisture control section: Between 8 and 20 inches or between 8 inches and the lithic contact when the lithic contact is less than 20 inches

Depth to the lithic contact: 10 to 20 inches

Note: Some pedons have a paralithic contact above the lithic contact.

A horizon

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 or 3

Clay content: 10 to 18 percent

Content of rock fragments: 15 to 35 percent—0 to 5 percent cobbles; 15 to 30 percent gravel

Reaction: pH 6.6 to 7.3

Bt horizons

Value: 5 or 6 dry; 4 or 5 moist

Texture: Loam or clay loam

Clay content: 20 to 35 percent

Content of rock fragments: 35 to 60 percent—0 to 5 percent cobbles; 35 to 55 percent gravel

Reaction: pH 6.6 to 7.9

BC horizon

Clay content: 12 to 18 percent

Content of rock fragments: 35 to 80 percent—0 to 10 percent cobbles; 35 to 70 percent gravel

Calcium carbonate equivalent: 0 to 2 percent

Reaction: pH 6.6 to 8.4

Fairway Series

Depth class: Very deep

Drainage class: Somewhat poorly drained

Permeability: Moderate

Landform: Flood plains and stream terraces

Parent material: Alluvium from mixed rock sources

Slope range: 0 to 4 percent

Elevation range: 5,600 to 6,200 feet

Annual precipitation: 10 to 14 inches

Annual air temperature: 40 to 44 degrees F

Frost-free period: 70 to 90 days

Taxonomic Class: Fine-loamy, mixed, superactive, frigid Fluvaquentic Haplustolls

Typical Pedon

Fairway clay loam, 0 to 2 percent slopes, in an area of cropland, 1,575 feet north and 2,550 feet west of the southeast corner of sec. 35, T. 2 N., R. 5 W. Jefferson County, Montana

A1—0 to 7 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, friable, moderately sticky, slightly plastic; common very fine roots; disseminated lime; slightly effervescent; slightly alkaline; clear smooth boundary.

A2—7 to 13 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; slightly hard, friable, moderately sticky, slightly plastic; many very fine and fine roots; common very fine tubular pores; disseminated lime; slightly effervescent; slightly alkaline; clear wavy boundary.

- Bk—13 to 25 inches; brown (10YR 5/3) silt loam, brown (10YR 4/3) moist; few fine distinct dark reddish brown (5YR 3/4) redox concentrations; weak medium prismatic structure parting to weak coarse subangular blocky; hard, friable, moderately sticky, slightly plastic; many very fine and fine roots; common very fine tubular pores; disseminated lime; few fine seams and masses of lime; strongly effervescent; moderately alkaline; clear smooth boundary.
- Bg—25 to 40 inches; pale brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; common or many fine distinct dark reddish brown (5YR 3/4) redox concentrations; massive; hard, friable, moderately sticky, moderately plastic; disseminated lime; slightly effervescent; slightly alkaline; clear smooth boundary.
- Cg—40 to 60 inches; dark grayish brown (10YR 4/2) silt loam with strata of fine sand, silty clay loam, and coarse sandy loam; very dark grayish brown (10YR 3/2) moist; many fine and medium prominent yellowish red (5YR 4/6) moist redox concentrations; massive; slightly hard, very friable, slightly sticky, nonplastic; common very fine and fine roots; neutral.

Range in Characteristics

Mean annual soil temperature: 42 to 46 degrees F

Thickness of the mollic epipedon: 10 to 15 inches

Depth to the seasonal high water table: 24 to 42 inches

A horizons

Value: 4 or 5 dry; 2 or 3 moist

Chroma: 1 or 2

Texture: Loam, silt loam, silty clay loam, or clay loam

Clay content: 15 to 35 percent

Calcium carbonate equivalent: 2 to 5 percent

Reaction: pH 6.6 to 8.4

Bk horizon

Hue: 10YR or 2.5Y

Value: 5 or 6 dry; 3 or 4 moist

Chroma: 2 or 3

Texture: Loam, silt loam, or clay loam

Clay content: 18 to 35 percent

Content of rock fragments: 0 to 10 percent gravel

Calcium carbonate equivalent: 5 to 15 percent: pH 7.4 to 8.4

Bg horizon

Hue: 10YR or 2.5Y

Value: 5 or 6 dry; 3 or 4 moist

Chroma: 1 to 3

Texture: Loam, silt loam, silty clay loam, with some thin strata of sandy loam, loamy sand, or clay loam

Clay content: 18 to 30 percent

Content of rock fragments: 0 to 10 percent gravel

Calcium carbonate equivalent: 2 to 10 percent: pH 7.4 to 8.4

Cg horizon

Hue: 10YR, 2.5Y, or 5Y

Value: 4 to 6 dry; 3 or 4 moist

Chroma: 1 or 2

Texture: Silt loam with strata of fine sand, silty clay loam, or coarse sandy loam

Clay content: 10 to 22 percent

Content of rock fragments: 0 to 20 percent gravel

Calcium carbonate equivalent: 0 to 10 percent

Reaction: pH 6.6 to 7.8

Faith Series

Depth class: Very deep

Drainage class: Moderately well drained

Permeability: Moderate

Landform: Flood plains and stream terraces

Parent material: Alluvium mainly from mixed rock sources

Slope range: 0 to 8 percent

Elevation range: 3,800 to 5,500 feet

Mean annual precipitation: 10 to 17 inches

Annual air temperature: 36 to 44 degrees F

Frost-free period: 80 to 115 days

Taxonomic Class: Fine-loamy, mixed, superactive, frigid Torrifluventic Haplustolls

Typical Pedon

Faith loam, 0 to 2 percent slopes, in an area of pastureland, 1,375 feet south and 75 feet west of the northeast corner of sec. 3, T. 1 N., R. 4 W. Jefferson County, Montana.

Ap1—0 to 4 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; soft, very friable, slightly sticky, nonplastic; many very fine and fine roots; slightly alkaline; clear smooth boundary.

Ap2—4 to 8 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky, slightly plastic; many very fine and fine roots; many very fine and fine tubular pores; disseminated lime; slightly effervescent; slightly alkaline; clear wavy boundary.

Bw—8 to 14 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; strong medium prismatic structure parting to moderate medium subangular blocky; slightly hard, firm, slightly sticky, slightly plastic; many very fine and fine roots; many very fine and fine tubular pores; disseminated lime; slightly effervescent; moderately alkaline; gradual wavy boundary.

Bk—14 to 31 inches; light brownish gray (10YR 6/2) silty clay loam, grayish brown (10YR 5/2) moist; strong coarse prismatic structure parting to strong medium subangular blocky; slightly hard, firm, slightly sticky, slightly plastic; many very fine and fine roots; many very fine and fine tubular pores; disseminated lime; few very fine threads of lime; strongly effervescent; moderately alkaline; clear smooth boundary.

2C—31 to 47 inches; light brownish gray (2.5Y 6/2) fine sandy loam, dark grayish brown (2.5Y 4/2) moist; massive; soft, very friable, nonsticky, nonplastic; few very fine roots; moderately alkaline; clear smooth boundary.

2Cg1—47 to 56 inches; grayish brown (2.5Y 5/2) silt loam, dark grayish brown (2.5Y 4/2) moist; common distinct yellowish red (5YR 5/6) redox concentrations; massive; slightly hard, very friable, slightly sticky, nonplastic; few very fine roots; moderately alkaline; clear smooth boundary.

2Cg2—56 to 60 inches; light olive gray (5Y 6/2) loam, olive gray (5Y 4/2) moist; common faint very dark gray (5Y 3/1) redox depletions; common faint yellowish

red (5YR 5/6) redox concentrations; massive; slightly hard, very friable, slightly sticky, nonplastic; moderately alkaline.

Range in Characteristics

Mean annual soil temperature: 38 to 46 degrees F

Moisture control section: Between 4 and 12 inches

Thickness of the mollic epipedon: 7 to 15 inches

Depth to the seasonal high water table: 42 to 60 inches for extended periods during spring and early summer

Ap horizons

Hue: 10YR or 2.5Y

Chroma: 2 or 3

Texture: Loam, sandy loam, or silt loam

Clay content: 15 to 27 percent

Content of rock fragments: 0 to 10 percent gravel

Calcium carbonate equivalent: 0 to 5 percent

Reaction: pH 6.6 to 7.8

Bw horizon

Hue: 10YR or 2.5Y

Value: 4 to 6 dry; 3 to 5 moist

Chroma: 2 or 3

Texture: Loam, silt loam, or silty clay loam with thin strata of finer and coarser materials

Clay content: 18 to 30 percent

Content of rock fragments: 0 to 10 percent gravel

Calcium carbonate equivalent: 0 to 10 percent

Reaction: pH 7.4 to 8.4

Bk horizon

Hue: 10YR or 2.5Y

Value: 5 to 7 dry; 4 to 6 moist

Chroma: 2 to 4

Texture: Loam, silt loam, silty clay loam, or clay loam with thin strata of finer and coarser materials

Clay content: 18 to 30 percent

Content of rock fragments: 0 to 10 percent gravel

Electrical conductivity: 0 to 2 mmhos/cm

Calcium carbonate equivalent: 5 to 15 percent

Reaction: pH 7.4 to 8.4

2C horizons

Hue: 10YR, 2.5Y, or 5Y

Value: 4 to 7 dry; 4 to 6 moist

Chroma: 1 to 3

Texture: Fine sandy loam, loam, silt loam, or very fine sandy loam

Clay content: 12 to 27 percent with 15 percent or more fine sand or coarser

Content of rock fragments: 0 to 15 percent gravel

Electrical conductivity: 0 to 4 mmhos/cm

Calcium carbonate equivalent: 1 to 15 percent

Reaction: pH 7.4 to 8.4

Finn Series

Depth class: Very deep

Drainage class: Very poorly drained

Permeability: Moderately slow

Landform: Flood plains and drainageways

Parent material: Alluvium

Slope range: 0 to 25 percent

Elevation range: 5,400 to 7,800 feet

Annual precipitation: 15 to 23 inches

Annual air temperature: 34 to 39 degrees F

Frost-free period: 30 to 70 days

Taxonomic Class: Loamy-skeletal, mixed, superactive Typic Cryaquolls

Typical Pedon

Finn gravelly loam, dry, 0 to 4 percent slopes, in an area of rangeland, 1,500 feet north and 700 feet west of the southeast corner of sec. 5, T. 2 N., R. 12 W.

Oi—0 to 2 inches; slightly decomposed organic matter.

A—2 to 12 inches; black (10YR 2/1) gravelly loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; slightly hard, very friable, nonsticky, slightly plastic; common medium and many very fine and fine roots; many very fine and fine discontinuous pores; 5 percent cobbles; 15 percent gravel; strongly acid; clear smooth boundary.

Bw1—12 to 18 inches; dark yellowish brown (10YR 3/4) very gravelly loam, yellowish brown (10YR 5/4) dry; common fine distinct yellowish brown (10YR 5/8) and brownish yellow (10YR 6/8) dry redox concentrations; weak fine subangular blocky structure; slightly hard, friable, slightly sticky, moderately plastic; common very fine and fine roots; many very fine and fine discontinuous pores; 5 percent cobbles; 35 percent gravel; strongly acid; clear smooth boundary.

2Bw2—18 to 24 inches; dark brown (10YR 3/3) very gravelly sandy clay loam, brown (10YR 5/3) dry; common fine distinct yellowish brown (10YR 5/8), brownish yellow (10YR 6/8) dry redox concentrations; weak fine subangular blocky structure; hard, firm, moderately sticky, moderately plastic; few very fine and fine roots; many very fine and fine discontinuous pores; 10 percent cobbles; 40 percent gravel; moderately acid; gradual wavy boundary.

2C—24 to 60 inches; dark yellowish brown (10YR 4/4) very gravelly sandy clay loam, light yellowish brown (10YR 6/4) dry; many medium distinct yellowish brown (10YR 5/8) and brownish yellow (10YR 6/8) dry redox concentrations; massive; hard, firm, slightly sticky, slightly plastic; few very fine and fine roots; many very fine and fine discontinuous pores; 15 percent cobbles; 40 percent gravel; moderately acid.

Range in Characteristics

Mean annual soil temperature: 36 to 41 degrees F

Moisture control section: Between 4 and 12 inches

Thickness of the mollic epipedon: 10 to 15 inches

Depth to the seasonal high water table: Ponded to 12 inches

A horizon

Chroma: 1 or 2

Clay content: 18 to 27 percent

Content of rock fragments: 0 to 35 percent—0 to 5 percent cobbles; 0 to 30 percent gravel
 Reaction: pH 5.1 to 7.3

Bw1 horizon

Redox concentrations: 10YR 6/8 and 10YR 5/8
 Clay content: 18 to 27 percent
 Content of rock fragments: 35 to 60 percent—5 to 15 percent cobbles; 30 to 45 percent gravel
 Reaction: pH 5.1 to 7.3

2Bw2 horizon

Redox concentrations: 10YR 5/8 and 10YR 6/8
 Texture: Sandy clay loam, loam or sandy loam
 Clay content: 18 to 27 percent
 Content of rock fragments: 35 to 60 percent—10 to 20 percent cobbles; 25 to 40 percent gravel
 Reaction: pH 5.6 to 7.3

2C horizon

Redox concentrations: 10YR 5/8 and 10YR 6/8
 Texture: Sandy clay loam or sandy loam
 Clay content: 18 to 27 percent
 Content of rock fragments: 35 to 70 percent—15 to 25 percent cobbles; 20 to 45 percent gravel
 Calcium carbonate equivalent: 0 to 5 percent
 Reaction: pH 5.6 to 7.3

Firada Series

Depth class: Moderately deep

Drainage class: Well drained

Permeability: Moderate

Landform: Mountain slopes

Parent material: Colluvium over residuum derived mainly from limestone

Slope range: 25 to 60 percent

Elevation range: 6,200 to 7,000 feet

Annual precipitation: 20 to 24 inches

Annual air temperature: 36 to 42 degrees F

Frost-free period: 50 to 70 days

Taxonomic Class: Loamy-skeletal, mixed, superactive Typic Eutrocrypts

Typical Pedon

Firada cobbly clay loam, in an area of Whitore-Firada cobbly clay loams, 15 to 60 percent slopes, in an area of woodland, 2,540 feet north and 1,209 feet west of the southeast corner of sec. 7, T. 12 N., R. 18 E. Fergus County, Montana.

Oi—0 to 1 inch; undecomposed and slightly decomposed forest litter.

E—1 to 4 inches; light gray (10YR 7/2) cobbly clay loam, brown (10YR 4/3) moist; moderate very fine and fine granular structure; slightly hard, very friable, slightly sticky, moderately plastic; many fine, medium, and coarse roots; many very fine and fine tubular pores; 25 percent angular cobbles; 5 percent angular gravel; slightly acid; clear wavy boundary.

Bw1—4 to 14 inches; brown (10YR 5/3) very cobbly clay loam, dark brown (10YR 4/3) moist; strong very fine and fine subangular blocky structure; hard, friable,

moderately sticky, moderately plastic; many fine, medium, and coarse roots; many very fine and fine tubular pores; 25 percent angular cobbles; 15 percent angular gravel; neutral; clear wavy boundary.

Bw2—14 to 18 inches; pale brown (10YR 6/3) very cobbly light clay loam, brown (10YR 4/3) moist; moderate very fine and fine subangular blocky structure; hard, friable, moderately sticky, moderately plastic; many fine, medium, and coarse roots; many very fine and fine tubular pores; 30 percent angular cobbles; 20 percent angular gravel; slightly effervescent; slightly alkaline; gradual wavy boundary.

Bk—18 to 26 inches; light brownish gray (10YR 6/2) extremely flaggy clay loam, dark grayish brown (10YR 4/2) moist; moderate very fine and fine subangular blocky structure; hard, friable, moderately sticky, moderately plastic; common fine, medium, and coarse roots; many very fine and fine tubular pores; 45 percent flagstones; 30 percent angular gravel; strongly effervescent; moderately alkaline.

R—26 inches; extremely hard fractured limestone.

Range in Characteristics

Mean annual soil temperature: 36 to 40 degrees F

Moisture control section: Between 4 and 12 inches

Depth to the lithic contact: 20 to 40 inches

Depth to the Bk horizon: 7 to 25 inches

Surface stones: 0.1 to 3 percent

E horizon

Hue: 10YR or 2.5Y

Value: 6 or 7 dry; 4 or 5 moist

Chroma: 2 or 3

Texture: Loam or clay loam

Clay content: 15 to 35 percent

Content of rock fragments: 15 to 50 percent—0 to 25 percent angular cobbles;
5 to 35 percent angular gravel

Reaction: pH 6.1 to 7.3

Bw1 horizon

Hue: 10YR or 2.5Y

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 or 3

Texture: Loam or clay loam

Clay content: 15 to 35 percent

Content of rock fragments: 30 to 60 percent—15 to 30 percent angular cobbles;
15 to 30 percent angular gravel

Reaction: pH 6.1 to 7.8

Bw2 horizon

Hue: 10YR or 2.5Y

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 or 3

Texture: Loam or clay loam

Clay content: 20 to 35 percent

Content of rock fragments: 30 to 60 percent—15 to 30 percent angular cobbles;
15 to 30 percent angular gravel

Reaction: pH 7.4 to 7.8

Bk horizon

Hue: 10YR or 2.5Y

Value: 5 to 7 dry; 4 to 6 moist

Chroma: 2 or 3
 Texture: Loam or clay loam
 Clay content: 15 to 35 percent
 Content of rock fragments: 35 to 80 percent—20 to 50 percent angular cobbles;
 20 to 30 percent angular gravel
 Calcium carbonate equivalent: 5 to 15 percent
 Reaction: pH 7.9 to 8.4

Foolhen Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Moderate
Landform: Drainageways, flood plains, and depressions on moraines
Parent material: Alluvium
Slope range: 0 to 8 percent
Elevation range: 5,900 to 7,500 feet
Annual precipitation: 15 to 19 inches
Annual air temperature: 34 to 38 degrees F
Frost-free period: 30 to 70 days

Taxonomic Class: Fine-loamy, mixed, superactive Typic Cryaquolls

Typical Pedon

Foolhen loam, in an area of Barbarela-Foolhen complex, 2 to 15 percent slopes, in an area of rangeland, 200 feet west and 500 feet south of the northeast corner of sec. 30, T. 9 S., R. 6 W.

- A—0 to 6 inches; dark grayish brown (10YR 4/2) loam, black (10YR 2/1) moist; weak fine and medium granular structure; soft, very friable, slightly sticky, nonplastic; many very fine, fine, medium, and coarse roots; neutral; clear wavy boundary.
 Bw—6 to 14 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; many medium distinct brownish yellow (10YR 6/6) dry redox concentrations; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky, nonplastic; many fine, medium, and coarse roots; neutral; gradual wavy boundary.
 C1—14 to 22 inches; brown (10YR 5/3) loam with thin lenses of sandy loam, brown (10YR 4/3) moist; many medium distinct brownish yellow (10YR 6/6) dry redox concentrations; massive; slightly hard, friable, slightly sticky, slightly plastic; many very fine and fine roots; 10 percent gravel; neutral; clear wavy boundary.
 C2—22 to 36 inches; light brownish gray (10YR 6/2) gravelly loam with thin lenses of sandy loam, dark grayish brown (10YR 4/2) moist; many medium distinct brownish yellow (10YR 6/6) dry redox concentrations; massive; slightly hard, very friable, slightly sticky, nonplastic; few very fine and fine roots; 20 percent gravel; neutral; clear wavy boundary.
 Cg—36 to 60 inches; grayish brown (10YR 5/2) loam with thin lenses of sandy loam, greenish gray (5GY 5/1) moist; massive; slightly hard, very friable, slightly sticky, nonplastic; 5 percent gravel; slightly alkaline.

Range in Characteristics

Mean annual soil temperature: 36 to 40 degrees F
Moisture control section: Between 4 and 12 inches
Thickness of the mollic epipedon: 10 to 19 inches
Depth to the seasonal high water table: 12 to 24 inches

A horizon

Value: 2 to 4 dry

Chroma: 1 or 2

Clay content: 14 to 27 percent

Content of rock fragments: 0 to 25 percent—0 to 5 percent cobbles; 0 to

20 percent gravel

Reaction: pH 6.1 to 7.3

Bw horizon

Value: 4 or 5 dry; 2 or 3 moist

Redox concentrations: 2.5Y 5/6, 10YR 5/4, or 10YR 5/6 moist; 2.5YR 6/6, 10YR 6/4, or 10YR 6/6 dry

Texture: Loam or sandy loam

Clay content: 18 to 27 percent

Content of rock fragments: 0 to 35 percent—0 to 10 percent cobbles; 0 to 25 percent gravel

Reaction: pH 6.1 to 7.8

C horizons

Hue: 10YR, 2.5Y, or 5Y

Value: 5 to 7 dry; 4 or 5 moist

Redox concentrations: 2.5Y 5/6, 10YR 5/4, or 10YR 5/6 moist; 2.5YR 6/6, 10YR 6/4, or 10YR 6/6 dry

Texture: Loam, silt loam, sandy loam, or sandy clay loam

Clay content: 18 to 30 percent

Content of rock fragments: 0 to 35 percent—0 to 5 percent cobbles; 0 to 30 percent gravel

Reaction: pH 6.1 to 7.8

Cg horizon

Value: 5 or 6 dry; 4 to 6 moist

Redox depletions: 5GY or 10GY

Chroma: 1 or 2

Texture: Loam, silt loam, or sandy loam

Clay content: 18 to 30 percent

Content of rock fragments: 0 to 50 percent—0 to 10 percent cobbles; 0 to 40 percent gravel

Reaction: pH 7.4 to 8.4

Fourmile Series

Depth class: Very deep

Drainage class: Somewhat excessively drained

Permeability: Moderate

Landform: Alluvial fans and hillsides

Parent material: Alluvium and colluvium from metamorphic granitic gneiss

Slope range: 8 to 25 percent

Elevation range: 6,200 to 7,000 feet

Annual precipitation: 15 to 19 inches

Annual air temperature: 34 to 38 degrees F

Frost-free period: 30 to 70 days

Taxonomic Class: Loamy-skeletal, mixed, superactive Ustic Argicryolls

Typical Pedon

Fourmile gravelly loam in an area of Fourmile complex, 8 to 25 percent slopes, in an area of rangeland, 700 feet south and 1,000 feet east of the northwest corner of sec. 4, T. 9 S., R. 6 W.

- A1—0 to 5 inches; grayish brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, very friable, slightly sticky, nonplastic; many fine and medium roots; 1 percent cobbles; 15 percent gravel; neutral; clear smooth boundary.
- A2—5 to 12 inches; brown (10YR 5/3) gravelly loam, dark brown (10YR 3/3) moist; weak medium and coarse subangular blocky structure; slightly hard, very friable, slightly sticky, nonplastic; many fine and medium roots; to inches; 1 percent cobbles; 25 percent gravel; neutral; clear smooth boundary.
- Bt—12 to 24 inches; yellowish brown (10YR 5/4) very gravelly sandy clay loam, dark yellowish brown (10YR 4/4) moist; moderate coarse prismatic structure; very hard, friable, moderately sticky and moderately plastic; common fine and medium roots; 5 percent cobbles; 35 percent gravel; neutral; clear wavy boundary.
- BC—24 to 36 inches; light yellowish brown (10YR 6/4) very gravelly sandy loam, yellowish brown (10YR 5/4) moist; weak coarse subangular blocky structure; slightly hard, very friable, nonsticky, nonplastic; 5 percent cobbles; 45 percent gravel; slightly alkaline; gradual wavy boundary.
- 2C—36 to 60 inches; variegated extremely gravelly sand; single grain; loose, nonsticky, nonplastic; 5 percent cobbles; 60 percent gravel; slightly alkaline.

Range in Characteristics

Mean annual soil temperature: 36 to 40 degrees F

Moisture control section: Between 4 and 12 inches

Thickness of the mollic epipedon: 10 to 15 inches

Depth to sandy-skeletal material: 20 to 40 inches

Surface stones and boulders: 0 to 15 percent

Note: Some pedons have carbonate coats on the undersides of rock fragments in the lower part of the 2C horizon below 40 inches.

A horizons

Value: 4 or 5 dry; 2 or 3 moist

Chroma: 2 or 3

Clay content: 12 to 24 percent

Content of rock fragments: 0 to 35 percent—0 to 5 percent cobbles; 0 to 30 percent gravel

Reaction: pH 6.6 to 7.3

Bt horizon

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 3, 4, or 6

Texture: Sandy clay loam, loam, or clay loam

Clay content: 24 to 35 percent

Content of rock fragments: 35 to 60 percent—0 to 10 percent cobbles; 35 to 50 percent gravel

Reaction: pH 6.6 to 7.3

BC horizon

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 4 or 6

Texture: Coarse sandy loam or sandy loam

Clay content: 12 to 20 percent

Content of rock fragments: 35 to 60 percent—0 to 10 percent cobbles; 35 to 60 percent gravel
 Reaction: pH 6.6 to 7.3

2C horizon

Texture: Loamy sand, sand, or coarse sand
 Clay content: 0 to 10 percent
 Content of rock fragments: 35 to 80 percent—0 to 10 percent cobbles; 35 to 70 percent gravel
 Calcium carbonate equivalent: 0 to 2 percent
 Reaction: pH 6.6 to 7.8

Gambler Series Family

Depth class: Very deep

Drainage class: Well drained

Permeability: Moderate

Landform: Mountain slopes

Parent material: Residuum and colluvium derived from mixed rock sources, dominantly andesite and basalt

Slope range: 20 to 45 percent

Elevation range: 6,200 to 8,600 feet

Annual precipitation: 14 to 28 inches

Annual air temperature: 36 to 41 degrees F

Frost-free period: 20 to 70 days

Taxonomic Class: Loamy-skeletal, mixed, superactive Ustic Glossocryalfs

Typical Pedon

Gambler gravelly loam in an area of Elve-Gambler-Libeg families complex, moderately steep mountain slopes. Beaverhead National Forest Area, Montana.

Oi—2 inches to 0; slightly decomposed forest litter.

E—0 to 8 inches; grayish brown (10YR 5/2) gravelly loam, dark grayish brown (10YR 4/2) moist; weak fine subangular blocky structure parting to weak fine granular; soft, very friable, nonsticky, nonplastic; common very fine, fine, medium, and coarse roots; 25 percent gravel; strongly acid; clear wavy boundary.

E/Bt1—8 to 18 inches; E part (80 percent) light gray (2.5Y 7/2) very gravelly sandy loam, grayish brown (2.5Y 5/2) moist; Bt part (20 percent) light yellowish brown (2.5Y 6/4) very gravelly sandy clay loam, light olive brown (2.5Y 5/4) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; common very fine, fine, medium, and coarse roots; few faint clay films bridging sand grains; 10 percent cobbles; 30 percent gravel; medium acid; clear wavy boundary.

E/Bt2—18 to 60 inches; E part (60 percent) light gray (2.5Y 7/2) very gravelly sandy clay loam, grayish brown (2.5Y 5/2) moist; Bt part (40 percent) light yellowish brown (2.5Y 6/4) very gravelly sandy clay loam, light olive brown (2.5Y 5/4) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; few very fine and fine and common medium and coarse roots; few faint clay films bridging sand grains; 15 percent cobbles; 35 percent gravel; medium acid.

Geohrock Series

Depth class: Very deep

Drainage class: Well drained

Permeability: Moderate

Landform: Hills, escarpments, and alluvial fans

Parent material: Gravelly alluvium and colluvium or glacial outwash

Slope range: 2 to 50 percent

Elevation range: 4,500 to 6,500 feet

Annual precipitation: 10 to 14 inches

Annual air temperature: 38 to 42 degrees F

Frost-free period: 70 to 105 days

Taxonomic Class: Loamy-skeletal, mixed, superactive, frigid Aridic Haplustalfs

Typical Pedon

Geohrock very cobbly sandy loam, very stony, 15 to 35 percent slopes, in an area of rangeland, 1,800 feet north and 1,400 feet west of the southeast corner of sec. 13, T. 5 S., R. 9 W. Glen topographic quadrangle (lat. 45°23'55"N; long. 112°39'20"W)

A—0 to 4 inches; brown (10YR 5/3) very cobbly sandy loam, dark brown (10YR 3/3) moist; weak fine and medium subangular blocky structure parting to weak very fine and fine granular; soft, very friable, slightly sticky, slightly plastic; few fine and medium and many very fine roots; 30 percent cobbles; 25 percent gravel; neutral; clear smooth boundary.

Bt—4 to 11 inches; yellowish brown (10YR 5/4) extremely cobbly clay loam, dark yellowish brown (10YR 4/4) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, moderately sticky, slightly plastic; few fine and medium and many very fine roots; common faint patchy clay films on faces of peds and bridging sand grains; 20 percent cobbles; 40 percent gravel; slightly alkaline; clear smooth boundary.

Bk1—11 to 23 inches; very pale brown (10YR 7/3) very cobbly sandy loam, yellowish brown (10YR 5/4) moist; weak fine and medium subangular blocky structure parting to weak very fine and fine granular; soft, very friable, slightly sticky, slightly plastic; few fine and common very fine roots; 20 percent cobbles; 35 percent gravel; disseminated lime; common fine and medium soft masses of lime; common continuous distinct lime casts on undersides of rock fragments; violently effervescent; moderately alkaline; clear wavy boundary.

Bk2—23 to 60 inches; brownish yellow (10YR 6/6) very cobbly sandy clay loam, yellowish brown (10YR 5/6) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; few very fine roots; 20 percent cobbles; 35 percent gravel; disseminated lime; few patchy carbonate coats on undersides of rock fragments; strongly effervescent; slightly alkaline.

Range in Characteristics

Mean annual soil temperature: 40 to 47 degrees F

Moisture control section: Between 4 and 12 inches

Depth to the Btk or Bk horizon: 6 to 15 inches

A horizon

Hue: 10YR or 2.5Y

Value: 4 to 7 dry; 3 to 5 moist

Chroma: 2 or 3

Texture: Sandy loam, sandy clay loam, or loam

Clay content: 15 to 25 percent

Content of rock fragments: 15 to 60 percent—0 to 30 percent cobbles; 15 to 30 percent gravel
 Reaction: pH 6.6 to 7.8

Bt horizon

Hue: 10YR or 2.5Y
 Value: 4 to 6 dry; 3 to 5 moist
 Chroma: 2 to 4
 Texture: Sandy clay loam or clay loam
 Clay content: 25 to 35 percent
 Content of rock fragments: 20 to 60 percent—0 to 20 percent cobbles; 20 to 50 percent gravel
 Calcium carbonate equivalent: 0 to 5 percent
 Reaction: pH 6.6 to 7.8

Bk horizons

Hue: 10YR or 2.5Y
 Value: 6 or 7 dry; 4 to 6 moist
 Chroma: 2 to 4 or 6
 Texture: Loam, sandy loam, or sandy clay loam
 Clay content: 10 to 25 percent
 Content of rock fragments: 35 to 80 percent—0 to 20 percent cobbles; 35 to 60 percent gravel
 Calcium carbonate equivalent: 5 to 15 percent
 Reaction: pH 7.6 to 9.0

Glendive Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderately rapid
Landform: Stream terraces and drainageways
Parent material: Calcareous alluvium
Slope range: 0 to 8 percent
Elevation range: 4,800 to 5,600 feet
Annual precipitation: 10 to 14 inches
Annual air temperature: 39 to 42 degrees F
Frost-free period: 90 to 105 days

Taxonomic Class: Coarse-loamy, mixed, superactive, calcareous, frigid Aridic Ustifluvents

Typical Pedon

Glendive sandy loam, 0 to 4 percent slopes, in an area of cropland, 1,000 feet east and 2,400 feet north of the southwest corner of sec. 3, T. 7 S., R. 8 W. Glen SE topographic quadrangle (lat. 45°15'14"N; long. 112°34'35"W)

Ap—0 to 6 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, nonsticky, nonplastic; many very fine, fine, and medium roots; strongly effervescent; moderately alkaline; clear smooth boundary.

C1—6 to 14 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 5/3) moist; weak fine and medium granular structure; slightly hard, very friable, nonsticky, nonplastic; many very fine, fine, and medium roots; strongly effervescent; moderately alkaline; clear smooth boundary.

C2—14 to 32 inches; light yellowish brown (2.5Y 6/3) sandy loam that consists of thin layers of very fine sandy loam, sandy loam, and loamy sand, light olive brown (2.5Y 5/3) moist; massive; slightly hard, very friable, nonsticky, nonplastic; common very fine and fine roots; 5 percent gravel; strongly effervescent; moderately alkaline; clear wavy boundary.

C3—32 to 60 inches; light yellowish brown (2.5Y 6/3) sandy loam, light olive brown (2.5Y 5/3) moist; massive; soft, very friable, nonsticky, nonplastic; slightly effervescent; slightly alkaline.

Range in Characteristics

Mean annual soil temperature: 42 to 44 degrees F

Moisture control section: Between 8 and 24 inches; dry in all parts between four-tenths and five-tenths of the cumulative days per year when the soil temperature at a depth of 20 inches is 41 degrees F or higher

Soil phase: Saline

Ap horizon

Hue: 10YR or 2.5Y

Value: 4 to 6 dry; 3 to 5 moist

Chroma: 2 or 3

Clay content: 10 to 18 percent

Electrical conductivity: 0 to 2 mmhos/cm (saline phase 4 to 8 mmhos/cm)

Reaction: pH 7.4 to 8.4 (saline phase pH 8.4 to 9.0)

C1 and C2 horizons

Hue: 10YR or 2.5Y

Value: 5 to 7 dry; 4 to 6 moist

Chroma: 2 to 4

Clay content: 5 to 18 percent

Content of rock fragments: 0 to 15 percent gravel

Electrical conductivity: 0 to 2 mmhos/cm (saline phase 8 to 16 mmhos/cm)

Reaction: pH 7.4 to 8.4 (saline phase pH 8.4 to 9.0)

C3 horizon

Hue: 10YR or 2.5Y

Value: 5 to 7 dry; 4 to 6 moist

Chroma: 2 to 4

Clay content: 5 to 18 percent

Content of rock fragments: 0 to 15 percent gravel

Electrical conductivity: 0 to 2 mmhos/cm (saline phase 8 to 25 mmhos/cm)

Reaction: pH 7.4 to 8.4 (saline phase pH 8.4 to 9.0)

Hanson Series

Depth class: Very deep

Drainage class: Well drained

Permeability: Moderate

Landform: Alluvial fans, moraines, and hillsides

Parent material: Colluvium and alluvium from limestone

Slope range: 8 to 60 percent

Elevation range: 5,600 to 6,500 feet

Annual precipitation: 15 to 19 inches

Annual air temperature: 34 to 38 degrees F

Frost-free period: 30 to 70 days

Taxonomic Class: Loamy-skeletal, carbonatic Calcic Haplocryolls

Typical Pedon

Hanson gravelly loam, very bouldery, in an area of Hanson complex, 8 to 25 percent slopes, in an area of rangeland, 1,200 feet south and 1,000 feet west of the northeast corner of sec. 21, T. 9 S., R. 8 W. Ashbough Canyon topographic quadrangle (lat. 45°02'23"N; long. 112°34'57"W)

- A1—0 to 5 inches; dark grayish brown (10YR 4/2) gravelly loam, very dark gray (10YR 3/1) moist; weak very fine and fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine, fine, and medium roots; 5 percent cobbles; 20 percent gravel; slightly alkaline; clear smooth boundary.
- A2—5 to 9 inches; brown (10YR 5/3) gravelly loam, dark brown (10YR 3/3) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, moderately sticky, moderately plastic; few medium and many very fine and fine roots; 25 percent gravel; disseminated lime; strongly effervescent; slightly alkaline; clear smooth boundary.
- Bk1—9 to 15 inches; light brownish gray (10YR 6/2) very gravelly loam, dark grayish brown (10YR 4/2) moist; weak medium and coarse subangular blocky structure; hard, friable, moderately sticky, moderately plastic; many very fine and fine roots; 35 percent gravel; many soft masses of lime; continuous distinct carbonate pendants on undersides of rock fragments; violently effervescent; moderately alkaline; clear smooth boundary.
- Bk2—15 to 27 inches; very pale brown (10YR 7/3) very gravelly loam, brown (10YR 5/3) moist; weak coarse subangular blocky structure; hard, friable, very sticky, very plastic; few very fine and fine roots; 50 percent gravel; many soft masses of lime; continuous distinct carbonate pendants on undersides of rock fragments; violently effervescent; moderately alkaline; gradual wavy boundary.
- Bk3—27 to 60 inches; light yellowish brown (10YR 6/4) extremely gravelly loam, yellowish brown (10YR 5/4) moist; weak coarse subangular blocky structure; very hard, friable, very sticky, very plastic; 10 percent cobbles; 55 percent gravel; disseminated lime; continuous distinct carbonate coats on rock fragments; violently effervescent; moderately alkaline.

Range in Characteristics

Mean annual soil temperature: 36 to 40 degrees F

Moisture control section: Between 4 and 12 inches; frozen in all or some part during the winter months

Thickness of the mollic epipedon: 7 to 16 inches

Depth to the calcic horizon: 7 to 16 inches

Surface stones and boulders: 0 to 3 percent

A1 horizon

Hue: 10YR or 2.5Y

Value: 3 to 5 dry; 2 or 3 moist

Chroma: 1 or 2

Clay content: 15 to 27 percent

Content of rock fragments: 5 to 50 percent—0 to 25 percent cobbles; 5 to 45 percent gravel

Reaction: pH 6.6 to 8.4

A2 horizon

Hue: 10YR or 2.5Y

Value: 3 to 5 dry; 2 or 3 moist

Chroma: 1 to 3

Clay content: 15 to 27 percent

Content of rock fragments: 5 to 55 percent—0 to 25 percent cobbles; 5 to 30 percent gravel

Calcium carbonate equivalent: 5 to 10 percent

Reaction: pH 6.6 to 7.8

Bk1 and Bk2 horizons

Hue: 10YR or 2.5Y

Value: 5 to 8 dry; 4 to 7 moist

Chroma: 2 to 4

Clay content: 15 to 27 percent

Content of rock fragments: 35 to 80 percent—0 to 35 percent cobbles; 10 to 60 percent gravel

Calcium carbonate equivalent: 30 to 40 percent in the less than 2 mm particle-size fraction and more than 40 percent in the less than 20 mm particle-size fraction.

Reaction: pH 7.9 to 8.4

Bk3 horizon

Hue: 10YR or 2.5Y

Value: 6 to 8 dry; 5 or 6 moist

Chroma: 2 to 4

Clay content: 18 to 27 percent

Content of rock fragments: 35 to 90 percent—10 to 35 percent stones or cobbles; 25 to 55 percent gravel or channers

Calcium carbonate equivalent: 15 to 30 percent in the less than 2 mm particle-size fraction and more than 40 percent in the less than 20 mm particle-size fraction.

Reaction: pH 7.9 to 8.4

Havre Series

Depth class: Very deep

Drainage class: Well drained

Permeability: Moderate

Landform: Stream terraces, flood plains, drainageways, and alluvial fans in valleys

Parent material: Calcareous loamy alluvium

Slope range: 0 to 4 percent

Elevation range: 4,800 to 6,200 feet

Annual precipitation: 10 to 14 inches

Annual air temperature: 38 to 42 degrees F

Frost-free period: 90 to 105 days

Taxonomic Class: Fine-loamy, mixed, superactive, calcareous, frigid Aridic Ustifluvents

Typical Pedon

Havre loam in an area of Havre-Glendive complex, 0 to 4 percent slopes, in an area of cropland, 2,500 feet east and 1,900 feet north of the southwest corner of sec. 12, T. 6 S., R. 8 W. Glen SE topographic quadrangle (lat. 45°19'31"N; long. 112°31'44"W)

Ap—0 to 6 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; weak very fine and fine granular structure; slightly hard, very friable, moderately sticky, moderately plastic; many very fine and fine roots; strongly effervescent; slightly alkaline; abrupt smooth boundary.

- C1—6 to 36 inches; pale brown (10YR 6/3) loam, consisting of thin strata of fine sandy loam, silt loam, and clay loam, brown (10YR 5/3) moist; massive; slightly hard, friable, moderately sticky, moderately plastic; many very fine and fine roots; strongly effervescent; slightly alkaline; clear wavy boundary.
- C2—36 to 60 inches; light brownish gray (10YR 6/2) loam, consisting of thin strata of fine sandy loam and silt loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable, slightly sticky, nonplastic; few very fine roots; strongly effervescent; slightly alkaline.

Range in Characteristics

Mean annual soil temperature: 40 to 47 degrees F

Moisture control section: Between 4 and 12 inches; dry in all parts between four-tenths and five-tenths of the cumulative days per year when the soil temperature at a depth of 20 inches is 41 degrees F or higher

Ap horizon

Hue: 10YR or 2.5Y

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 or 3

Texture: Loam, silt loam, or silty clay loam

Clay content: 18 to 35 percent

Calcium carbonate equivalent: 1 to 10 percent

Reaction: pH 7.4 to 7.8

C1 horizon

Hue: 10YR or 2.5Y

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 or 3

Clay content: 18 to 27 percent

Calcium carbonate equivalent: 1 to 10 percent

Reaction: pH 7.4 to 8.4

C2 horizon

Hue: 10YR or 2.5Y

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 or 3

Clay content: 18 to 27 percent

Calcium carbonate equivalent: 1 to 10 percent

Reaction: pH 7.4 to 8.4

Haxby Series

Depth class: Moderately deep

Drainage class: Well drained

Permeability: Moderate

Landform: Structural benches, strike ridges, hills, and alluvial fans

Parent material: Calcareous alluvium and colluvium over residuum

Slope range: 4 to 60 percent

Elevation range: 4,800 to 6,500 feet

Annual precipitation: 10 to 14 inches

Annual air temperature: 38 to 42 degrees F

Frost-free period: 70 to 105 days

Taxonomic Class: Coarse-loamy, mixed, superactive, frigid Haplocalcidic
Haplustepts

Typical Pedon

Haxby loam, in an area of Amesha-Haxby-Rencot complex, 4 to 15 percent slopes, in an area of cropland, 1,800 feet south and 1,600 feet east of the northwest corner of sec. 27, T. 7 S., R. 9 W. Dillon West topographic quadrangle (lat. 45°11'54"N; long. 112°41'46"W)

Ap—0 to 5 inches; light brownish gray (2.5Y 6/2) loam, olive brown (2.5Y 4/3) moist; weak fine and medium subangular blocky structure parting to weak very fine and fine granular; slightly hard, very friable, slightly sticky, slightly plastic; few fine and common very fine roots; 10 percent gravel; disseminated lime; strongly effervescent; slightly alkaline; clear smooth boundary.

Bk1—5 to 18 inches; light gray (10YR 7/2) loam, pale brown (10YR 6/3) moist; weak medium subangular blocky structure parting to moderate very fine and fine subangular blocky; slightly hard, very friable, slightly sticky, slightly plastic; few fine and common very fine roots; 10 percent gravel; disseminated lime; common fine and medium soft masses of lime; violently effervescent; moderately alkaline; clear smooth boundary.

Bk2—18 to 23 inches; light gray (2.5Y 7/2) gravelly sandy loam, light yellowish brown (2.5Y 6/3) moist; weak fine and medium subangular blocky structure parting to weak very fine and fine granular; soft, very friable, slightly sticky, nonplastic; few very fine and fine roots; 25 percent gravel; disseminated lime; many distinct lime casts on undersides of rock fragments; few fine soft masses of lime; violently effervescent; moderately alkaline; abrupt wavy boundary.

R—23 inches; hard igneous bedrock.

Range in Characteristics

Mean annual soil temperature: 40 to 47 degrees F

Moisture control section: Between 8 and 24 inches

Depth to the Bk horizon: 4 to 6 inches

Depth to the lithic contact: 20 to 40 inches

Note: Some pedons have a paralithic contact above the lithic contact.

Ap horizon

Hue: 10YR or 2.5Y

Value: 5 or 6 dry; 3 or 4 moist

Chroma: 2 to 4

Texture: Sandy loam or loam

Clay content: 10 to 25 percent

Content of rock fragments: 0 to 20 percent gravel

Reaction: pH 6.6 to 7.8

Bk1 horizon

Hue: 10YR or 2.5Y

Value: 6 to 8 dry; 5 to 7 moist

Chroma: 2 to 4

Texture: Loam or sandy loam

Clay content: 10 to 18 percent

Content of rock fragments: 0 to 25 percent gravel

Calcium carbonate equivalent: 15 to 25 percent

Reaction: pH 7.9 to 8.4

Bk2 horizon

Hue: 10YR or 2.5Y

Value: 6 to 8 dry; 5 to 7 moist

Chroma: 2 to 4

Texture: Loam or sandy loam

Clay content: 10 to 18 percent
 Content of rock fragments: 0 to 25 percent gravel
 Calcium carbonate equivalent: 5 to 15 percent
 Reaction: pH 7.9 to 8.4

Kalsted Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderately rapid
Landform: Alluvial fans, hills, escarpments, and stream terraces
Parent material: Calcareous alluvium
Slope range: 0 to 45 percent
Elevation range: 4,800 to 6,500 feet
Annual precipitation: 10 to 14 inches
Annual air temperature: 38 to 42 degrees F
Frost-free period: 70 to 105 days

Taxonomic Class: Coarse-loamy, mixed, superactive, frigid Aridic Calciustepts

Typical Pedon

Kalsted sandy loam, in an area of Amesha-Kalsted complex, 2 to 8 percent slopes, in an area of rangeland, 700 feet east and 1,700 feet south of the northwest corner of sec. 7, T. 7 S., R. 7 W. Dillon East topographic quadrangle (lat. 45°14'34"N; long. 112°30'55"W)

- A—0 to 3 inches; grayish brown (10YR 5/2) sandy loam, brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; soft, very friable, nonsticky, nonplastic; common very fine, fine, and medium roots; disseminated lime; strongly effervescent; slightly alkaline; clear smooth boundary.
- Bk1—3 to 22 inches; light gray (10YR 7/2) sandy loam, light brownish gray (10YR 6/2) moist; weak coarse subangular blocky structure; slightly hard, very friable, nonsticky, nonplastic; common very fine, fine, and medium roots; 5 percent gravel; many fine soft masses of lime; violently effervescent; moderately alkaline; clear smooth boundary.
- Bk2—22 to 52 inches; very pale brown (10YR 7/3) gravelly sandy loam, pale brown (10YR 6/3) moist; weak coarse subangular blocky structure; soft, very friable, slightly sticky, nonplastic; 20 percent gravel; continuous distinct carbonate coats on surface of gravel; many fine soft masses of lime; violently effervescent; moderately alkaline; clear wavy boundary.
- BC—52 to 60 inches; light gray (10YR 7/2) gravelly sandy loam, stratified with common thin lenses of loamy sand, light brownish gray (10YR 6/2) moist; massive; soft, very friable, nonsticky, nonplastic; 20 percent gravel; disseminated lime; strongly effervescent; moderately alkaline.

Range in Characteristics

Mean annual soil temperature: 40 to 47 degrees F
Moisture control section: Between 8 and 24 inches; dry in all parts between four-tenths and five-tenths of the cumulative days per year when the soil temperature at a depth of 20 inches is 41 degrees F or higher
Depth to the Bk horizon: 3 to 7 inches
Surface stones: 0 to 0.1 percent

A horizon

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 or 3

Texture: Sandy loam or loamy sand

Clay content: 5 to 18 percent

Content of rock fragments: 0 to 35 percent—0 to 10 percent cobbles; 0 to 25 percent gravel

Calcium carbonate equivalent: 5 to 10 percent

Reaction: pH 7.4 to 8.4

Bk1 horizon

Value: 6 to 8 dry; 4 to 7 moist

Chroma: 2 or 3

Clay content: 10 to 15 percent

Content of rock fragments: 0 to 35 percent—0 to 5 percent cobbles; 0 to 30 percent gravel

Calcium carbonate equivalent: 15 to 30 percent

Reaction: pH 7.4 to 8.4

Bk2 horizon

Value: 6 to 8 dry; 5 to 7 moist

Chroma: 2 to 4

Clay content: 10 to 15 percent

Content of rock fragments: 5 to 35 percent—0 to 5 percent cobbles; 5 to 30 percent gravel

Calcium carbonate equivalent: 15 to 30 percent

Reaction: pH 7.9 to 8.4

BC horizon

Value: 6 or 7 dry; 4 to 6 moist

Chroma: 2 to 4

Clay content: 5 to 15 percent

Content of rock fragments: 10 to 35 percent gravel

Calcium carbonate equivalent: 10 to 20 percent

Reaction: pH 7.9 to 8.4

Kimpton Series

Depth class: Moderately deep

Drainage class: Well drained

Permeability: Moderate

Landform: Ridges and mountains

Parent material: Local colluvium, slope alluvium, and residuum from hard, fine-grained sandstone or fine-grained igneous rock

Slope range: 25 to 50 percent

Elevation range: 5,500 to 7,000 feet

Annual precipitation: 15 to 24 inches

Annual air temperature: 36 to 40 degrees F

Frost-free period: 30 to 70 days

Taxonomic Class: Loamy-skeletal, mixed, superactive Ustic Haplocryalfs

Typical Pedon

Kimpton very cobbly loam, in an area of Kimpton, very bouldery-Rock outcrop-Tiban, very bouldery, complex, 25 to 50 percent slopes, in an area of forestland, 300 feet

south and 150 feet east of the northwest corner of sec. 4, T. 5 N., R. 2 W. Jefferson County, Montana

Oi—0 to 1 inch; partially decomposed needles, twigs, and leaves.

A—1 to 5 inches; dark grayish brown (10YR 4/2) very cobbly loam, dark brown (10YR 3/3) moist; moderate medium granular structure; soft, very friable, slightly sticky, nonplastic; few medium and common very fine and fine roots; many very fine and fine interstitial and tubular pores; 20 percent angular cobbles; 25 percent angular gravel; neutral; clear wavy boundary.

E—5 to 7 inches; grayish brown (10YR 5/2) very cobbly loam, brown (10YR 4/3) moist; moderate medium granular structure; slightly hard, very friable, slightly sticky, slightly plastic; few medium and many very fine and fine roots; many very fine and fine interstitial and tubular pores; 20 percent angular cobbles; 20 percent angular gravel; slightly acid; clear wavy boundary.

Bt—7 to 14 inches; brown (10YR 5/3) very cobbly clay loam, dark brown (10YR 3/3) moist; moderate medium subangular blocky structure; hard, firm, slightly sticky, slightly plastic; common very fine and fine roots; common medium interstitial and tubular pores; common distinct very dark grayish brown (10YR 3/2) clay films on faces of peds and bridging sand grains; 20 percent angular cobbles; 25 percent angular gravel; neutral; clear wavy boundary.

Bk—14 to 33 inches; pale brown (10YR 6/3) very cobbly loam, brown (10YR 5/3) moist; weak medium subangular blocky structure; soft, very friable, slightly sticky, nonplastic; common very fine and fine roots; common very fine and fine interstitial and tubular pores; 25 percent angular cobbles; 25 percent angular gravel; disseminated lime; common fine and medium masses and threads of lime, common distinct carbonate coats on undersides of rock fragments; strongly effervescent; slightly alkaline.

R—33 to 43 inches; hard, fine-grained sandstone bedrock.

Range in Characteristics

Mean annual soil temperature: 38 to 42 degrees F

Moisture control section: Between 4 and 12 inches

Depth to the Bt horizon: 6 to 10 inches

Depth to the Bk horizon: 11 to 20 inches

Depth to bedrock: 20 to 40 inches

Surface stones or boulders: 0.1 to 3 percent

A horizon

Hue: 10YR or 2.5Y

Value: 4 or 5 dry; 3 or 4 moist

Chroma: 2 or 3

Clay content: 15 to 27 percent

Content of rock fragments: 35 to 50 percent—0 to 5 percent stones; 10 to 20 percent cobbles; 25 to 30 percent gravel

Reaction: pH 6.1 to 7.3

E horizon

Hue: 10YR or 2.5Y

Value: 5 to 7 dry; 4 to 6 moist

Chroma: 2 or 3

Texture: Loam or fine sandy loam

Clay content: 15 to 27 percent

Content of rock fragments: 25 to 55 percent—0 to 10 percent stones; 10 to 20 percent cobbles; 15 to 35 percent gravel

Reaction: pH 6.1 to 7.3

Bt horizon

Hue: 10YR or 2.5Y
 Value: 5 or 6 dry; 3 to 5 moist
 Chroma: 2 or 3
 Texture: Loam, sandy clay loam, or clay loam
 Clay content: 23 to 35 percent
 Content of rock fragments: 35 to 60 percent—0 to 5 percent stones; 10 to 20 percent cobbles; 25 to 40 percent gravel
 Reaction: pH 6.6 to 7.3

Bk horizon

Hue: 10YR or 2.5Y
 Value: 6 or 7 dry; 5 or 6 moist
 Chroma: 2 or 3
 Texture: Loam, sandy clay loam, or fine sandy loam
 Clay content: 15 to 27 percent
 Content of rock fragments: 35 to 60 percent—0 to 5 percent stones; 10 to 25 percent cobbles; 25 to 40 percent gravel
 Calcium carbonate equivalent: 12 to 25 percent
 Reaction: pH 7.4 to 8.4

Kounter Taxadjunct

Depth class: Shallow

Drainage class: Somewhat excessively drained

Permeability: Moderately rapid

Landform: Ridges, strike ridges, and hills in foothills

Parent material: Residuum from metamorphic rocks

Slope range: 4 to 45 percent

Elevation range: 5,700 to 6,500 feet

Annual precipitation: 10 to 14 inches

Annual air temperature: 36 to 40 degrees F

Frost-free period: 70 to 90 days

Taxonomic Class: Loamy-skeletal, mixed, superactive, frigid Aridic Lithic Haplustepts

Typical Pedon

Kounter Taxadjunct gravelly sandy loam, in an area of Kounter taxadjunct-Amesha-Rock outcrop complex, 8 to 35 percent slopes, in an area of rangeland, 1,600 feet west and 2,500 feet south of the northeast corner of sec. 11, T. 9 S., R. 8 W. Ashbough Canyon topographic quadrangle (lat. 45°03'56"N; long. 112°32'37"W)

A—0 to 3 inches; dark grayish brown (10YR 4/2) gravelly sandy loam, very dark grayish brown (10YR 3/2) moist; weak very fine and fine granular structure; soft, very friable, nonsticky, nonplastic; many very fine, fine, and medium roots; 15 percent gravel; slightly alkaline; clear smooth boundary.

Bw—3 to 7 inches; grayish brown (10YR 5/2) gravelly sandy loam, dark grayish brown (10YR 4/2) moist; weak fine and medium subangular blocky structure; soft, very friable, nonsticky, nonplastic; many very fine, fine, and medium roots; 20 percent gravel; disseminated lime; slightly effervescent; moderately alkaline; clear wavy boundary.

Bk—7 to 12 inches; light gray (2.5Y 7/2) very gravelly sandy loam, grayish brown (2.5Y 5/2) moist; weak medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; common very fine and fine roots;

5 percent cobbles; 35 percent gravel; many fine and medium soft masses of lime; moderately alkaline; clear smooth boundary.

Cr—12 to 16 inches; light brownish gray (2.5Y 6/2) decomposed schist bedrock (grus) that crushes to gravelly loamy sand.

R—16 inches; schist bedrock.

Range in Characteristics

Mean annual soil temperature: 38 to 42 degrees F

Moisture control section: Between 4 and 12 inches or between 4 inches and the lithic contact when bedrock is less than 12 inches

Depth to the Bk horizon: 6 to 10 inches

Depth to the Cr horizon: 10 to 18 inches

Depth to the lithic contact: 12 to 20 inches

Surface stones and boulders: 0 to 3 percent

Note: The surface layer, when mixed to 7 inches, does not meet the requirements of a mollic epipedon.

A horizon

Hue: 10YR or 2.5Y

Value: 4 to 6 dry; 3 to 5 moist

Chroma: 2 or 3

Clay content: 10 to 20 percent

Content of rock fragments: 15 to 50 percent—0 to 5 percent stones; 0 to 20 percent cobbles; 15 to 30 percent gravel

Reaction: pH 6.6 to 7.9

Bw horizon

Hue: 10YR or 2.5Y

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 or 3

Texture: Coarse sandy loam or sandy loam

Clay content: 8 to 18 percent

Content of rock fragments: 15 to 60 percent—0 to 5 percent stones; 0 to 15 percent cobbles; 15 to 40 percent gravel

Calcium carbonate equivalent: 0 to 5 percent

Reaction: pH 6.6 to 8.4

Bk horizon

Hue: 10YR or 2.5Y

Value: 6 or 7 dry; 5 or 6 moist

Chroma: 2 or 3

Texture: Coarse sandy loam or sandy loam

Clay content: 8 to 18 percent

Content of rock fragments: 35 to 70 percent—0 to 5 percent stones; 0 to 15 percent cobbles; 35 to 50 percent gravel

Calcium carbonate equivalent: 5 to 20 percent

Reaction: pH 7.4 to 8.4

Leavitt Series

Depth class: Very deep

Drainage class: Well drained

Permeability: Moderate

Landform: Hillsides, escarpments, and terraces

Parent material: Alluvium

Slope range: 2 to 25 percent

Elevation range: 6,000 to 7,500 feet

Annual precipitation: 15 to 19 inches

Annual air temperature: 36 to 40 degrees F

Frost-free period: 60 to 90 days

Taxonomic Class: Fine-loamy, mixed, superactive Ustic Argicryolls

Typical Pedon

Leavitt stony loam, 2 to 25 percent slopes, in an area of rangeland, 1,500 feet east and 1,000 feet south of the northwest corner of sec. 16, T. 9 S., R. 1 E. Madison County, Montana.

A—0 to 8 inches; dark grayish brown (10YR 4/2) stony loam, very dark grayish brown (10YR 3/2) moist; moderate very fine granular structure; soft, very friable, nonsticky, nonplastic; 10 percent stones or cobbles; 15 percent gravel; neutral; abrupt irregular boundary.

Bt—4 to 13 inches; brown (10YR 4/3) stony clay loam, dark brown (10YR 3/3) moist; strong fine subangular blocky structure; hard, friable, moderately sticky, moderately plastic; common thin clay films on ped faces and in pores; 10 percent stones or cobbles; 15 percent gravel; neutral; clear smooth boundary.

Btk—13 to 21 inches; pale brown (10YR 6/3) gravelly clay loam, brown (10YR 4/3) moist; moderate medium prismatic structure; hard, friable, moderately sticky and moderately plastic; 5 percent cobbles; 20 percent gravel; neutral; clear wavy boundary.

Bk1—21 to 38 inches; white (10YR 8/2) gravelly loam, light brownish gray (10YR 6/2) moist; weak coarse prismatic structure; slightly hard, very friable, slightly sticky, slightly plastic; 5 percent cobbles; 20 percent gravel; violently effervescent; mildly alkaline; gradual smooth boundary.

Bk2—38 to 60 inches; light gray (10YR 7/2) gravelly loam, grayish brown (10YR 5/2) moist; massive; slightly hard, very friable, slightly sticky, slightly plastic; 5 percent cobbles; 20 percent gravel; mildly effervescent; moderately alkaline.

Range in Characteristics

Mean annual soil temperature: 36 to 40 degrees F

Thickness of the mollic epipedon: 7 to 15 inches

Moisture control section: Between 4 and 12 inches

Note: Accumulations of carbonates may exceed 15 percent but are discontinuous throughout the pedon.

A horizon

Value: 3 to 5 dry; 2 or 3 moist

Chroma: 1 to 3

Clay content: 18 to 25 percent

Content of rock fragments: 0 to 25 percent—(0 to 10 percent stones or cobbles; 0 to 15 percent gravel)

Reaction: pH 6.1 to 7.8

Bt horizon

Value: 4 to 6 dry; 3 to 5 moist

Chroma: 1 to 4

Texture: Clay loam, loam or silty clay loam

Clay content: 18 to 35 percent

Content of rock fragments: 0 to 25 percent—(0 to 10 percent stones or cobbles; 0 to 15 percent gravel)

Reaction: pH 6.1 to 7.8

Btk horizon

Value: 5 to 7 dry; 4 to 6 moist

Chroma: 2 to 4

Texture: Clay loam, loam, silt loam, or silty clay loam

Clay content: 18 to 35 percent

Content of rock fragments: 0 to 25 percent—(0 to 5 percent cobbles; 0 to 20 percent gravel)

Reaction: pH 7.4 to 8.4

Bk horizons

Value: 6 to 8 dry; 5 or 6 moist

Chroma: 2 to 4

Texture: Loam, clay loam, or sandy clay loam

Clay content: 18 to 35 percent

Content of rock fragments: 0 to 35 percent—(0 to 5 percent cobbles; 0 to 20 percent gravel)

Calcium carbonate equivalent: 4 to 15 percent

Reaction: pH 7.9 to 9.0

Libeg Family

Depth class: Very deep

Drainage class: Well drained

Permeability: Moderate

Landform: Alluvial fans and hills on foothills and mountains

Parent material: Colluvium, alluvium, or glacial till of mixed rock fragments

Slope range: 4 to 60 percent

Elevation range: 6,100 to 8,500 feet

Annual precipitation: 15 to 20 inches

Annual air temperature: 34 to 38 degrees F

Frost-free period: 30 to 70 days

Taxonomic Class: Loamy-skeletal, mixed, superactive Ustic Argicryolls

Typical Pedon

Libeg cobbly loam, stony, in an area of Libeg, stony-Poin, very stony-Rock outcrop complex, 25 to 60 percent slopes, in an area of rangeland, 1,200 feet east and 700 feet south of the northwest corner of sec. 3, T. 9 S., R. 7 W. Elk Gulch topographic quadrangle (lat. 45°05'12"N; long. 112°27'07"W)

A—0 to 15 inches; dark grayish brown (10YR 4/2) cobbly loam, very dark brown (10YR 2/2) moist; moderate coarse granular structure; soft, very friable, nonsticky, nonplastic; common medium and coarse and many very fine and fine roots; 10 percent cobbles; 10 percent gravel; slightly acid; clear smooth boundary.

Bt1—15 to 24 inches; pale brown (10YR 6/3) very cobbly loam, dark brown (10YR 3/3) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; common very fine, fine, and medium and few coarse roots; faint clay films on faces of peds and rock fragments; 20 percent cobbles; 15 percent gravel; slightly acid; gradual wavy boundary.

Bt2—24 to 34 inches; light yellowish brown (10YR 6/4) very cobbly sandy clay loam, dark yellowish brown (10YR 4/4) moist; moderate medium subangular blocky structure; hard, firm, slightly sticky, moderately plastic; few medium and common very fine and fine roots; distinct clay films on faces of peds and rock fragments; 20 percent cobbles; 20 percent gravel; slightly acid; gradual wavy boundary.

BC—34 to 60 inches; pale brown (10YR 6/3) extremely gravelly sandy loam, brown (10YR 4/3) moist; weak fine subangular blocky structure; soft, very friable, nonsticky, nonplastic; few very fine and fine roots; 15 percent cobbles; 45 percent gravel; neutral.

Range in Characteristics

Mean annual soil temperature: 36 to 40 degrees F; ustic moisture regime that borders on udic

Thickness of the mollic epipedon: 7 to 15 inches

Surface stones and boulders: 0 to 15 percent

A horizon

Value: 3 to 5 dry; 2 or 3 moist

Chroma: 1 or 2

Clay content: 10 to 20 percent

Content of rock fragments: 10 to 60 percent—0 to 25 percent cobbles; 10 to 35 percent gravel

Reaction: pH 6.1 to 7.3

Bt1 horizon

Hue: 7.5YR or 10YR

Value: 4 to 6 dry; 3 to 5 moist

Chroma: 2 or 3

Texture: Loam, sandy loam, or clay loam

Clay content: 15 to 35 percent

Content of rock fragments: 35 to 70 percent—10 to 30 percent cobbles; 15 to 40 percent gravel

Reaction: pH 6.1 to 7.8

Bt2 horizon

Hue: 7.5YR or 10YR

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 3 or 4

Texture: Clay loam or sandy clay loam

Clay content: 20 to 35 percent

Content of rock fragments: 35 to 70 percent—0 to 30 percent cobbles; 20 to 50 percent gravel

Reaction: pH 6.1 to 7.3

BC horizon

Hue: 7.5YR or 10YR

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 to 4

Texture: Sandy loam or loam

Clay content: 10 to 20 percent

Content of rock fragments: 40 to 75 percent—10 to 30 percent cobbles; 30 to 45 percent gravel

Reaction: pH 6.1 to 7.3

Loberg Series Family

Depth class: Very deep

Drainage class: Well drained

Permeability: Moderate

Landform: Mountain slopes

Parent material: Alluvium, colluvium, and till derived from mixed rock sources

Slope range: 25 to 45 percent
Elevation range: 6,200 to 8,600 feet
Annual precipitation: 14 to 28 inches
Annual air temperature: 36 to 41 degrees F
Frost-free period: 20 to 70 days

Taxonomic Class: Clayey-skeletal, mixed, superactive Ustic Glossocryalfs

Typical Pedon: Loberg loam

Oi—1 inch to 0; slightly decomposed forest litter.
 E—0 to 8 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; weak fine and medium granular structure; slightly hard, friable, slightly sticky, slightly plastic; common very fine, fine, medium, and coarse roots; 10 percent gravel; strongly acid; clear wavy boundary.
 E/Bt—8 to 20 inches; E part (60 percent) light brownish gray (10YR 6/2) cobbly loam, dark grayish brown (10YR 4/2) moist; Bt part (40 percent) light yellowish brown (10YR 6/4) cobbly clay loam, dark yellowish brown (10YR 4/4) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; common thin clay films on faces of peds; common very fine, fine, medium, and coarse roots; 15 percent cobbles; 10 percent gravel; medium acid; clear wavy boundary.
 Bt—20 to 60 inches; reddish yellow (7.5YR 6/6) very cobbly clay loam, strong brown (7.5YR 5/6) moist; strong medium subangular blocky structure; hard, firm, moderately sticky and moderately plastic; common fine, medium, and coarse roots; many thin clay films on faces of peds; 25 percent cobbles; 15 percent gravel; slightly acid.

Maciver Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderate
Landform: Fan terraces, alluvial fans, and moraines
Parent material: Alluvium from mixed rock sources
Slope range: 1 to 60 percent
Elevation range: 6,300 to 7,600 feet
Annual precipitation: 15 to 19 inches
Annual air temperature: 34 to 38 degrees F
Frost-free period: 30 to 70 days

Taxonomic Class: Loamy-skeletal, mixed, superactive Ustic Argicryolls

Typical Pedon

Maciver gravelly loam, in an area of Tiban-Maciver gravelly loams, 2 to 8 percent slopes, in an area of rangeland, 1,600 feet west and 2,000 feet south of the northeast corner of sec. 8, T. 10 S., R. 5 W. Swamp Creek topographic quadrangle (lat. 44°58'52"N; long. 112°14'15"W)

A—0 to 5 inches; dark grayish brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure parting to weak fine and medium granular; soft, very friable, nonsticky, nonplastic; many very fine, fine, and medium roots; 15 percent gravel; neutral; clear smooth boundary.

- Bt—5 to 12 inches; brown (10YR 5/3) very gravelly clay loam, dark brown (10YR 3/3) moist; moderate fine and medium subangular blocky structure; hard, friable, moderately sticky, slightly plastic; many very fine, fine, and medium roots; few faint clay films on faces of peds; 5 percent cobbles; 35 percent gravel; neutral; clear wavy boundary.
- Bk1—12 to 25 inches; pale brown (10YR 6/3) very gravelly loam, brown (10YR 5/3) moist; moderate fine and medium subangular blocky structure; hard, very friable, moderately sticky, slightly plastic; common very fine and fine roots; 5 percent cobbles; 40 percent gravel; many medium soft masses of lime; violently effervescent; moderately alkaline; clear wavy boundary.
- Bk2—25 to 60 inches; light gray (10YR 7/2) very gravelly loam, light brownish gray (10YR 6/2) moist; weak coarse subangular blocky structure; hard, very friable, slightly sticky, nonplastic; few very fine roots; 10 percent cobbles; 45 percent gravel; many medium soft masses of lime; violently effervescent; moderately alkaline.

Range in Characteristics

Mean annual soil temperature: 36 to 40 degrees F

Moisture control section: Between 4 and 12 inches

Thickness of the mollic epipedon: 7 to 15 inches

Depth to the argillic horizon: 5 to 12 inches

Depth to the calcic horizon: 11 to 22 inches

A horizon

Value: 3 or 4 dry; 2 or 3 moist

Chroma: 1 or 2

Clay content: 18 to 27 percent

Content of rock fragments: 0 to 35 percent—0 to 5 percent cobbles; 0 to 30 percent gravel

Reaction: pH 6.6 to 7.3

Bt horizon

Value: 4 to 6 dry; 3 to 5 moist

Chroma: 2 to 4

Clay content: 27 to 35 percent

Content of rock fragments: 35 to 60 percent—0 to 10 percent cobbles; 35 to 50 percent gravel

Reaction: pH 6.6 to 7.3

Bk horizons

Hue: 10YR or 2.5Y

Value: 6 to 8 dry; 5 or 6 moist

Chroma: 2 to 4

Texture: Loam, sandy clay loam, or sandy loam

Clay content: 15 to 27 percent

Content of rock fragments: 40 to 70 percent—5 to 15 percent cobbles; 35 to 55 percent gravel

Calcium carbonate equivalent: 15 to 35 percent

Reaction: pH 7.9 to 8.4

Madbeaver Series

Depth class: Very deep

Drainage class: Somewhat poorly drained

Permeability: Moderate in the upper 48 inches and rapid below

Landform: Alluvial fans and stream terraces in valleys

Parent material: Calcareous alluvium

Slope range: 0 to 4 percent

Elevation range: 4,500 to 6,500 feet

Annual precipitation: 10 to 14 inches

Annual air temperature: 39 to 45 degrees F

Frost-free period: 70 to 105 days

Taxonomic Class: Fine-loamy, mixed, superactive, frigid Aridic Calcustepts

Typical Pedon

Madbeaver silt loam, 0 to 2 percent slopes, in an area of rangeland, 150 feet south and 700 feet east of the northwest corner of sec. 6, T. 8 S., R. 8 W. Dillon West topographic quadrangle (lat. 45°10'26"N; long. 112°38'16"W)

- A—0 to 9 inches; gray (10YR 6/1) silt loam, dark gray (10YR 4/1) moist; weak medium prismatic structure parting to moderate fine and medium subangular blocky; slightly hard, friable, moderately sticky, slightly plastic; few fine and medium and many very fine roots; common fine and many very fine interstitial pores; disseminated lime; violently effervescent; slightly alkaline; clear smooth boundary.
- Bk1—9 to 25 inches; very pale brown (10YR 8/2) silt loam, pale brown (10YR 6/3) moist; weak medium prismatic structure parting to moderate fine and medium subangular blocky; slightly hard, friable, slightly sticky, slightly plastic; few fine and common very fine roots; few fine and many very fine interstitial pores; common threads and masses of lime; violently effervescent; strongly alkaline; clear smooth boundary.
- Bk2—25 to 33 inches; light gray (10YR 7/2) loam, light brownish gray (10YR 6/2) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; few very fine roots; common very fine interstitial pores; few fine prominent strong brown (7.5YR 5/6) redox concentrations; common threads and masses of lime; violently effervescent; moderately alkaline; clear smooth boundary.
- C—33 to 48 inches; light gray (2.5Y 7/2) fine sandy loam, light brownish gray (2.5Y 6/2) moist; massive; soft, very friable, slightly sticky, nonplastic; few very fine roots and interstitial pores; common fine, medium, and coarse prominent strong brown (7.5YR 5/6) redox concentrations; disseminated lime; violently effervescent; moderately alkaline; abrupt smooth boundary.
- 2Cg—48 to 60 inches; pale yellow (5Y 8/2) extremely gravelly loamy sand, light olive gray (5Y 6/2) moist; single grain; loose; 15 percent cobbles; 50 percent gravel; disseminated lime; strongly effervescent; moderately alkaline.

Range in Characteristics

Mean annual soil temperature: 40 to 47 degrees F; frigid soil temperature regime

Moisture control section: Between 4 and 12 inches; ustic moisture regime: dry in all parts between four-tenths and five-tenths of the cumulative days per year when the soil temperature at a depth of 20 inches is 41 degrees F or higher

Depth to the Bk horizon: 4 to 10 inches

Depth to the 2C horizon: 40 to 60 inches

Depth to the seasonal high water table: 24 to 42 inches

A horizon

Hue: 10YR or 2.5Y

Value: 5 or 6 dry; 3 or 4 moist

Chroma: 1 or 2

Texture: Silt loam or silty clay loam
Clay content: 20 to 35 percent
Content of rock fragments: 0 to 10 percent gravel
Calcium carbonate equivalent: 5 to 25 percent
Reaction: pH 7.4 to 8.4

Bk horizons

Hue: 10YR or 2.5Y
Value: 6 to 8 dry; 4 to 6 moist
Chroma: 1 to 3
Texture: Silt loam, silty clay loam, loam, or sandy clay loam
Clay content: 18 to 35 percent
Content of rock fragments: 0 to 25 percent gravel
Calcium carbonate equivalent: 15 to 40 percent
Reaction: pH 7.9 to 8.6

C horizon

Hue: 10YR or 2.5Y
Value: 6 to 8 dry; 4 to 6 moist
Chroma: 1 to 3
Texture: Fine sandy loam, sandy clay loam, loam, silt loam, or silty clay loam
Clay content: 15 to 35 percent
Content of rock fragments: 0 to 25 percent gravel
Calcium carbonate equivalent: 10 to 40 percent
Reaction: pH 7.4 to 8.4

2Cg horizon

Hue: 5Y or 2.5Y
Value: 6 to 8 dry; 5 or 6 moist
Chroma: 2 or 3
Texture: Loamy sand, sand, loamy coarse sand, or coarse sand
Clay content: 0 to 10 percent
Content of rock fragments: 35 to 80 percent—0 to 20 percent cobbles; 35 to 60 percent gravel
Calcium carbonate equivalent: 5 to 30 percent
Reaction: pH 7.9 to 8.6

Meadowcreek Series

Depth class: Very deep

Drainage class: Somewhat poorly drained

Permeability: Moderate over rapid

Landform: Flood plains, drainageways, and stream terraces

Parent material: Alluvium

Slope range: 0 to 4 percent

Elevation range: 3,500 to 6,200 feet

Annual precipitation: 10 to 19 inches

Annual air temperature: 39 to 45 degrees F

Frost-free period: 70 to 120 days

Taxonomic Class: Fine-loamy over sandy or sandy-skeletal, mixed, superactive, frigid Fluvaquentic Haplustolls

Typical Pedon

Meadowcreek loam, in an area of cropland, 1,300 feet south and 2,000 feet east of the northwest corner of sec. 8, T. 10 N., R. 3 W. (lat. 46°30'35"N; long. 112°00'47"W) Lewis and Clark County, Montana.

- Ap—0 to 5 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure; slightly hard, friable, moderately sticky, slightly plastic; many very fine roots; strongly effervescent; moderately alkaline; abrupt smooth boundary.
- A2—5 to 10 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak fine and medium subangular blocky; slightly hard, friable, moderately sticky, slightly plastic; common very fine roots; many fine tubular and interstitial pores; strongly effervescent; moderately alkaline; clear smooth boundary.
- A3—10 to 15 inches; gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) moist; weak medium prismatic structure; slightly hard, friable, moderately sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; slightly alkaline; clear smooth boundary.
- Bg1—15 to 27 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; few fine distinct brown (7.5YR 5/3) moist redox concentrations; weak coarse prismatic structure; few thin very dark grayish brown (10YR 3/2) moist, layers of soils; slightly hard, friable, moderately sticky, slightly plastic; common very fine roots; many very fine tubular and interstitial pores; neutral; gradual smooth boundary.
- Bg2—27 to 31 inches; gray (10YR 6/1) sandy loam, dark grayish brown (10YR 4/2) moist; common fine distinct brown (7.5YR 5/4) moist redox concentrations; weak coarse prismatic structure; slightly hard, friable, nonsticky, moderately plastic; common very fine roots; many very fine tubular and interstitial pores; few gravel; neutral; clear smooth boundary.
- 2C—31 to 60 inches; variegated colors, very gravelly sand; single grain; loose, nonsticky, nonplastic; few very fine roots; 55 percent gravel; neutral.

Minestope Series

Depth class: Shallow

Drainage class: Somewhat excessively drained

Permeability: Rapid

Landform: Hillslopes, ridges, mountainflanks, and bedrock-floored pediments

Parent material: Residuum from quartz monzonite, granite, or other coarse-grained igneous or metamorphic rocks

Slope range: 2 to 60 percent

Elevation range: 5,500 to 7,000 feet

Annual precipitation: 15 to 19 inches

Annual air temperature: 34 to 40 degrees F

Frost-free period: 30 to 70 days

Taxonomic Class: Sandy-skeletal, mixed, shallow Ustic Haplocryolls

Typical Pedon

Minestope gravelly coarse sandy loam, in an area of grassland, 1,950 feet east and 1,850 feet north of the southwest corner of sec. 14, T. 2 N., R. 8 W. Butte South topographic quadrangle, UTM zone 12T, 0378918E, 5086306N, NAD 27. Silver Bow County, Montana.

- A—0 to 7 inches; brown (10YR 4/3) gravelly coarse sandy loam, dark brown (10YR 3/3) moist; weak medium granular structure; soft, very friable, slightly sticky, nonplastic; common very fine, fine, and medium roots; 15 percent fine subangular pea gravel; slightly acid, clear smooth boundary.
- Bw—7 to 13 inches; brown (10YR 5/3) gravelly coarse sandy loam, brown (10YR 4/3) moist; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky, nonplastic; few fine and medium and common very fine roots; 30 percent fine subangular pea gravel; neutral; clear wavy boundary.
- BC—13 to 18 inches; light gray (10YR 7/2) very gravelly loamy coarse sand, grayish brown (10YR 5/2) moist; single grain; loose, nonsticky, nonplastic; few very fine roots; 45 percent fine subangular pea gravel; neutral; clear wavy boundary.
- Cr—18 to 23 inches; soft weathered granite bedrock.
- R—23 inches; hard granite bedrock.

Note: These soils contain a high proportion of medium, coarse, and very coarse angular sand in the sand fraction due to granite or granitelike parent materials.

Mooseflat Series

Depth class: Very deep

Drainage class: Very poorly drained

Permeability: Moderate

Landform: Flood plains

Parent material: Recent alluvium from mixed rock sources

Slope range: 4 to 8 percent

Elevation range: 5,500 to 7,500 feet

Annual precipitation: 15 to 24 inches

Annual air temperature: 36 to 40 degrees F

Frost-free period: 30 to 70 days

Taxonomic Class: Fine-loamy over sandy or sandy-skeletal, mixed, superactive
Typic Cryaquolls

Typical Pedon

Mooseflat loam, in an area of Mooseflat-Elvick loams, 1 to 4 percent slopes, in an area of pastureland, 1,600 feet east and 1,700 feet south of the northwest corner of sec. 22, T. 6 N., R. 6 W. Jefferson County, Montana.

- Oe—0 to 2 inches; black (10YR 2/1) moderately decomposed plant material, very dark grayish brown (10YR 3/2) dry; neutral; clear smooth boundary.
- A—2 to 10 inches; black (10YR 2/1) loam, gray (10YR 5/1) dry; many fine distinct yellowish brown (10YR 5/6) redox concentrations; moderate medium granular structure; slightly hard, friable, slightly sticky, moderately plastic; many very fine and fine roots; neutral; clear smooth boundary.
- Bg—10 to 18 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; common fine distinct dark yellowish brown (10YR 4/6) redox concentrations; weak thin platy structure; hard, friable, slightly sticky, slightly plastic; many very fine and fine roots; common very fine pores; neutral; abrupt smooth boundary.
- BCg—18 to 22 inches; dark gray (10YR 4/1) loamy fine sand, light gray (10YR 7/1) dry; common fine distinct yellowish brown (10YR 5/4) redox concentrations; weak medium subangular blocky structure; soft, very friable, nonsticky, nonplastic; few fine roots; common very fine pores; 5 percent rounded gravel; neutral; abrupt smooth boundary.

2Cg—22 to 60 inches; gray (10YR 5/1) very cobbly loamy sand, light gray (10YR 6/1) dry; single grain; loose, nonsticky, nonplastic; 35 percent rounded cobbles; 25 percent rounded gravel; neutral.

Range in Characteristics

Mean annual soil temperature: 38 to 42 degrees F

Moisture control section: Between 4 and 12 inches

Thickness of the mollic epipedon: 10 to 19 inches

Depth to the 2Cg horizon: 14 to 26 inches

Depth to the seasonal high water table: 0 to 12 inches from April through June

A horizon

Hue: 10YR, 2.5Y, or 5Y

Value: 2 or 3 moist; 4 or 5 dry

Chroma: 1 or 2

Clay content: 15 to 27 percent

Content of rock fragments: 0 to 10 percent cobbles or gravel

Reaction: pH 5.6 to 7.3

Bg horizon

Hue: 10YR, 2.5Y, or 5Y

Value: 2 to 5 moist; 4 to 6 dry

Chroma: 1 or 2

Texture: Loam or silt loam

Clay content: 18 to 27 percent

Content of rock fragments: 0 to 10 percent cobbles or gravel

Reaction: pH 6.1 to 7.3

BCg horizon

Hue: 10YR, 2.5Y, or 5Y

Value: 4 or 5 moist; 6 or 7 dry

Chroma: 1 or 2

Texture: Fine sandy loam or loamy fine sand

Clay content: 10 to 18 percent

Content of rock fragments: 5 to 20 percent—0 to 5 percent cobbles; 5 to 15 percent gravel

Reaction: pH 6.1 to 7.3

2Cg horizon

Hue: 10YR or 2.5Y

Value: 5 to 7 dry

Texture: Sand, loamy sand, coarse sand, or loamy coarse sand

Clay content: 2 to 12 percent

Content of rock fragments: 35 to 70 percent—15 to 50 percent stones or cobbles; 20 to 35 percent gravel

Reaction: pH 5.6 to 7.3

Musselshell Series

Depth class: Very deep

Drainage class: Well drained

Permeability: Moderate

Landform: Alluvial fans, hills, stream terraces, and escarpments

Parent material: Calcareous alluvium or colluvium derived from limestone

Slope range: 0 to 35 percent

Elevation range: 4,500 to 6,500 feet

Annual precipitation: 10 to 14 inches

Annual air temperature: 38 to 45 degrees F

Frost-free period: 70 to 105 days

Taxonomic Class: Coarse-loamy, carbonatic, frigid Aridic Calcustepts

Typical Pedon

Musselshell loam, in an area of Musselshell-Roto-Pensore complex, 4 to 15 percent slopes, in an area of rangeland, 2,150 feet south and 600 feet east of the northwest corner of sec. 28, T. 7 S., R. 9 W. Dillon West topographic quadrangle (lat. 45°11'51"N; long. 112°43'14"W)

A—0 to 4 inches; grayish brown (2.5Y 5/2) loam, olive brown (2.5Y 4/3) moist; weak fine and medium subangular blocky structure parting to weak very fine and fine granular; soft, very friable, slightly sticky, slightly plastic; few fine and common very fine roots; 5 percent gravel; strongly effervescent; slightly alkaline; clear smooth boundary.

Bk1—4 to 15 inches; light yellowish brown (2.5Y 6/3) loam, light olive brown (2.5Y 5/3) moist; weak medium prismatic structure parting to moderate fine and medium subangular blocky; slightly hard, friable, slightly sticky, slightly plastic; few fine and common very fine roots; 5 percent gravel; disseminated lime; few fine irregular soft masses of lime; violently effervescent; moderately alkaline; clear smooth boundary.

Bk2—15 to 34 inches; light gray (2.5Y 7/2) loam, light olive brown (2.5Y 5/3) moist; weak fine and medium subangular blocky structure parting to moderate very fine and fine granular; slightly hard, friable, slightly sticky, slightly plastic; few very fine and fine roots; 5 percent gravel; disseminated lime; common fine and medium irregular soft masses of lime; violently effervescent; strongly alkaline; clear smooth boundary.

Bk3—34 to 40 inches; pale yellow (2.5Y 7/3) gravelly loam, light olive brown (2.5Y 5/3) moist; weak fine and medium subangular blocky structure parting to weak very fine and fine granular; soft, very friable, slightly sticky, slightly plastic; few very fine roots; 15 percent gravel; disseminated lime; few fine irregular soft masses of lime; violently effervescent; moderately alkaline; clear smooth boundary.

2C—40 to 60 inches; light gray (2.5Y 7/2) very gravelly loam, light brownish gray (2.5Y 6/2) moist; soft, very friable, slightly sticky, slightly plastic; few very fine roots; 50 percent gravel; disseminated lime; few fine and medium irregular soft masses of lime; common distinct carbonate coats on gravel; violently effervescent; moderately alkaline.

Range in Characteristics

Mean annual soil temperature: 40 to 47 degrees F

Moisture control section: 8 to 24 inches; dry in all parts between four-tenths and five-tenths of the cumulative days per year when the soil temperature at a depth of 20 inches is 41 degrees F or higher

Depth to the 2C horizon: 20 to 40 inches

A horizon

Hue: 10YR or 2.5Y

Value: 4 to 6 dry; 3 or 4 moist

Chroma: 2 to 4

Texture: Loam or silt loam

Clay content: 10 to 27 percent

Content of rock fragments: 0 to 60 percent—0 to 25 percent stones or cobbles;
 0 to 35 percent gravel
 Calcium carbonate equivalent: 5 to 15 percent
 Reaction: pH 7.4 to 8.4

Bk horizons

Hue: 10YR or 2.5Y
 Value: 5 to 8 dry; 4 to 7 moist
 Chroma: 1 to 4
 Texture: Loam or sandy loam
 Clay content: 10 to 27 percent
 Content of rock fragments: 0 to 35 percent—0 to 10 percent cobbles; 0 to 25 percent gravel
 Calcium carbonate equivalent: 40 to 60 percent
 Reaction: pH 7.9 to 9.0

2C horizon

Hue: 10YR or 2.5Y
 Value: 5 to 8 dry; 4 to 7 moist
 Chroma: 2 to 4
 Texture: Fine sandy loam, sandy loam, or loam
 Clay content: 10 to 18 percent
 Content of rock fragments: 35 to 60 percent—5 to 10 percent cobbles; 30 to 50 percent gravel
 Calcium carbonate equivalent: 40 to 60 percent
 Reaction: pH 7.9 to 9.0

Nathale Series

Depth class: Moderately deep

Drainage class: Well drained

Permeability: Moderate

Landform: Strike ridges, hillsides, and mountain slopes

Parent material: Residuum from sandstone, siltstone, and shale

Slope range: 15 to 60 percent

Elevation range: 5,500 to 6,600 feet

Annual precipitation: 15 to 19 inches

Annual air temperature: 36 to 42 degrees F

Frost-free period: 50 to 70 days

Taxonomic Class: Loamy-skeletal, mixed, superactive Ustic Argicryolls

Typical Pedon

Nathale very channery sandy clay loam, in an area of Nathale, very bouldery-Poin, very flaggy-Rock outcrop complex, 20 to 60 percent slopes, in an area of rangeland, 1,100 feet east and 2,400 feet south of the northwest corner of sec. 19, T. 4 S., R. 9 W. Twin Adams Mountain topographic quadrangle (lat. 45°28'27"N; long. 112°46'08"W)

A—0 to 10 inches; light olive brown (2.5Y 5/3) very channery sandy clay loam, dark olive brown (2.5Y 3/3) moist; weak fine and medium subangular blocky structure parting to weak very fine and fine granular; soft, very friable, slightly sticky, slightly plastic; few fine and many very fine roots; 10 percent flagstones; 40 percent channers; neutral; clear smooth boundary.

- Bt1—10 to 14 inches; light olive brown (2.5Y 5/3) extremely channery loam, olive brown (2.5Y 4/3) moist; moderate very fine and fine subangular blocky structure; slightly hard, friable, moderately sticky, slightly plastic; few fine and many very fine roots; common distinct clay films on faces of peds and rock fragments; 15 percent flagstones; 50 percent channers; neutral; clear smooth boundary.
- Bt2—14 to 23 inches; light olive brown (2.5Y 5/3) extremely channery loam, olive brown (2.5Y 4/3) moist; weak very fine and fine subangular blocky structure parting to moderate very fine and fine granular; soft, very friable, moderately sticky, slightly plastic; few fine and many very fine roots; many distinct clay films on faces of peds and rock fragments; 15 percent flagstones; 50 percent channers; neutral; clear smooth boundary.
- Bt3—23 to 31 inches; light olive brown (2.5Y 5/4) extremely channery sandy clay loam, olive brown (2.5Y 4/4) moist; weak very fine and fine granular structure; soft, very friable, moderately sticky, slightly plastic; few fine and many very fine roots; many distinct clay films on faces of peds and rock fragments; 15 percent flagstones; 50 percent channers; neutral; clear smooth boundary.
- Bk—31 to 39 inches; light yellowish brown (2.5Y 6/3) extremely channery sandy clay loam, olive brown (2.5Y 4/4) moist; weak very fine and fine granular structure; soft, very friable, slightly sticky, slightly plastic; few very fine and fine roots; 15 percent flagstones; 50 percent channers; disseminated lime; strongly effervescent; slightly alkaline.
- R—39 inches; hard slate bedrock.

Range in Characteristics

Mean annual soil temperature: 38 to 42 degrees F

Moisture control section: Between 4 and 12 inches

Thickness of the mollic epipedon: 7 to 15 inches

Depth to the argillic horizon: 5 to 10 inches

Depth to the Bk horizon: 11 to 31 inches

Depth to the lithic contact: 20 to 40 inches

Note: Some pedons have a paralithic contact above the lithic contact.

A horizon

Hue: 10YR or 2.5Y

Value: 4 or 5 dry; 2 or 3 moist

Chroma: 2 or 3

Texture: Sandy clay loam, sandy loam, or loam

Clay content: 15 to 25 percent

Content of rock fragments: 20 to 60 percent—0 to 20 percent flagstones or cobbles; 20 to 40 percent channers or gravel

Reaction: pH 6.1 to 7.3

Bt horizons

Hue: 10YR or 2.5Y

Value: 4 to 6 dry; 3 to 5 moist

Chroma: 2 to 4

Texture: Sandy clay loam, loam, or clay loam

Clay content: 22 to 35 percent

Content of rock fragments: 35 to 70 percent—0 to 20 percent flagstones or cobbles; 35 to 50 percent channers or gravel

Reaction: pH 6.6 to 7.6

Bk horizon

Hue: 10YR, 2.5Y, or 5Y

Value: 6 or 7 dry; 4 to 6 moist

Chroma: 2 to 4

Texture: Sandy clay loam, loam, or silt loam
 Clay content: 15 to 25 percent
 Content of rock fragments: 35 to 70 percent—0 to 20 percent flagstones or cobbles; 35 to 50 percent channers or gravel
 Calcium carbonate equivalent: 15 to 25 percent
 Reaction: pH 7.6 to 8.4

Neen Series

Depth class: Very deep
Drainage class: Somewhat poorly drained
Permeability: Moderately slow
Landform: Stream terraces, flood plains, and alluvial fans
Parent material: Alluvium
Slope range: 0 to 4 percent
Elevation range: 4,800 to 6,000 feet
Annual precipitation: 10 to 14 inches
Annual air temperature: 38 to 42 degrees F
Frost-free period: 70 to 105 days

Taxonomic Class: Fine-silty, mixed, superactive, frigid Aridic Calcustepts

Typical Pedon

Neen silt loam, in an area of Neen-Ashbough, saline-Beavrock complex, 0 to 4 percent slopes, in an area of rangeland, 400 feet west and 200 feet south of the northeast corner of sec. 28, T. 5 S., R. 7 W. Beaverhead Rock topographic quadrangle (lat. 45°22'43"N; long. 112°27'56"W)

- Oi—0 to 1 inch; partially decomposed sedges, grasses, and shrubs; moderately alkaline; abrupt smooth boundary.
- Az1—1 to 4 inches; grayish brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; slightly hard, friable, moderately sticky, moderately plastic; many very fine, fine, medium, and coarse roots; many very fine salt crystals; disseminated lime; strongly effervescent; moderately alkaline; abrupt smooth boundary.
- Az2—4 to 10 inches; gray (10YR 6/1) silty clay loam, dark gray (10YR 4/1) moist; moderate fine and medium granular structure; slightly hard, friable, moderately sticky, moderately plastic; many very fine, fine, medium, and coarse roots; many very fine salt crystals; disseminated lime; strongly effervescent; strongly alkaline; abrupt wavy boundary.
- Bkz1—10 to 26 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; weak medium and coarse subangular blocky structure; hard, friable, very sticky, very plastic; common fine and medium roots; many very fine salt crystals; common fine soft masses of lime; violently effervescent; strongly alkaline; clear wavy boundary.
- Bkz2—26 to 42 inches; white (5Y 8/1) silty clay loam, gray (5Y 6/1) moist; few fine distinct strong brown (7.5YR 5/6) redox concentrations; weak very coarse subangular blocky structure; hard, friable, very sticky, very plastic; common fine and medium roots; few very fine salt crystals; many coarse soft masses of lime; violently effervescent; moderately alkaline; clear smooth boundary.
- Bkzg—42 to 60 inches; light gray (5Y 7/1) silty clay loam, dark greenish gray (5GY 4/1) moist; common very fine, fine, and medium prominent strong brown (7.5YR 5/6) redox concentrations; massive; extremely hard, very firm, moderately sticky,

very plastic; few very fine and fine roots; few very fine salt crystals; few fine soft masses of lime; strongly effervescent; moderately alkaline.

Range in Characteristics

Mean annual soil temperature: 40 to 44 degrees F

Moisture control section: Between 4 and 12 inches

Depth to the seasonal high water table: 24 to 50 inches; mainly 30 to 45 inches

Note: Some pedons do not have an O horizon.

Az1 horizon

Hue: 10YR or 2.5Y

Value: 5 to 7 dry; 2 to 4 moist

Chroma: 1 or 2

Texture: Silty clay loam or silt loam

Clay content: 18 to 35 percent

Sodium adsorption ratio: 13 to 30 percent

Electrical conductivity: 2 to 16 mmhos/cm

Reaction: pH 7.9 to 9.0

Az2 horizon

Hue: 10YR or 2.5Y

Value: 5 to 7 dry; 2 to 4 moist

Chroma: 1 or 2

Texture: Silty clay loam or silt loam

Clay content: 18 to 35 percent

Sodium adsorption ratio: 13 to 30 percent

Electrical conductivity: 2 to 16 mmhos/cm

Reaction: pH 7.9 to 9.0

Bkz horizons

Hue: 2.5Y or 5Y

Value: 6 to 8 dry; 5 to 7 moist

Chroma: 1 or 2

Redox concentrations: none to few 10YR 6/1, 7.5YR 5/6, 5YR 4/6, or 5YR 5/8

Texture: Silty clay loam or silt loam

Clay content: 18 to 35 percent

Calcium carbonate equivalent: 20 to 40 percent

Sodium adsorption ratio: 13 to 30

Electrical conductivity: 2 to 16 mmhos/cm

Reaction: pH 7.9 to 9.0

Bkzg horizon

Hue: 2.5Y, 5Y, or 5GY

Value: 6 to 8 dry; 3 to 6 moist

Chroma: 1 or 2

Redox concentrations: Few or many 10YR 6/1, 7.5YR 5/6, 5YR 4/6, or 5YR 5/8

Texture: Silty clay loam, clay loam, loam, or silt loam

Clay content: 18 to 35 percent

Calcium carbonate equivalent: 15 to 35 percent

Sodium adsorption ratio: < 13

Electrical conductivity: 2 to 16 mmhos/cm

Reaction: pH 7.9 to 9.0

Newton Series

Depth class: Very deep

Drainage class: Very poorly drained

Permeability: Moderately slow

Landform: Stream terraces and marshes

Parent material: Alluvium

Slope range: 0 to 2 percent

Elevation range: 5,600 to 6,300 feet

Annual precipitation: 10 to 14 inches

Annual air temperature: 37 to 40 degrees F

Frost-free period: 70 to 90 days

Taxonomic Class: Fine-loamy, mixed, superactive, calcareous, frigid Histic Humaquepts

Typical Pedon

Newton mucky peat, in an area of Newton-Dougcliff complex, 0 to 2 percent slopes, in an area of wetland, 400 feet east and 2,500 feet south of the northwest corner of sec. 7, T. 10 S., R. 6 W. Price Creek topographic quadrangle (lat. 44°58'44"N; long. 112°23'39"W)

- Oe—0 to 8 inches; light brownish gray (10YR 6/2) mucky peat, very dark gray (10YR 3/1) moist; strongly effervescent; moderately alkaline; clear smooth boundary.
- Ag—8 to 12 inches; gray (N 6/) silt loam, very dark gray (N 3/) moist; weak coarse subangular blocky structure; hard, firm, slightly sticky, slightly plastic; common medium and coarse and many very fine and fine roots; disseminated lime; strongly effervescent; moderately alkaline; clear smooth boundary.
- Cg1—12 to 18 inches; light gray (N 7/) silt loam, dark gray (N 4/) moist; massive; very hard, very firm, moderately sticky, moderately plastic; many very fine and fine and few medium and coarse roots; disseminated lime; strongly effervescent; moderately alkaline; clear wavy boundary.
- Cg2—18 to 36 inches; light greenish gray (5GY 7/1) clay loam, greenish gray (5GY 6/1) moist; massive; very hard, very firm, moderately sticky, moderately plastic; common very fine and fine and few medium and coarse roots; disseminated lime; strongly effervescent; moderately alkaline; clear wavy boundary.
- 2Cg3—36 to 60 inches; light yellowish brown (2.5Y 6/2) gravelly sandy loam, light olive brown (2.5Y 5/2) moist; many medium and coarse prominent brownish yellow (10YR 6/6) redox concentrations; massive; hard, firm, nonsticky, nonplastic; 20 percent gravel; disseminated lime; very slightly effervescent; moderately alkaline.

Range in Characteristics

Mean annual soil temperature: 39 to 42 degrees F

Moisture control section: Between 4 and 12 inches

Thickness of the histic epipedon: 8 to 16 inches

Depth to the 2C horizon: 22 to 36 inches

Depth to the seasonal high water table: Ponded to 12 inches

Oe horizon

Hue: 10YR or N

Value: 3 to 6 dry; 2 to 4 moist

Chroma: 1 or 2

Reaction: pH 7.4 to 8.4

Ag horizon

Hue: 10YR or N
 Value: 4 to 6 dry; 3 or 4 moist
 Chroma: 1
 Clay content: 20 to 27 percent
 Calcium carbonate equivalent: 2 to 15 percent
 Reaction: pH 7.9 to 8.4

Cg horizons

Hue: 5GY or N
 Value: 5 to 7 dry; 4 to 6 moist
 Chroma: 1
 Texture: Silt loam, clay loam, or silty clay loam
 Clay content: 20 to 35 percent
 Calcium carbonate equivalent: 2 to 15 percent
 Reaction: pH 7.9 to 8.4

2Cg3 horizon

Hue: 2.5Y, 5Y, or N
 Value: 5 or 6 dry; 4 or 5 moist
 Chroma: 1 or 2
 Texture: Sandy clay loam or sandy loam
 Clay content: 18 to 30 percent
 Content of rock fragments: 15 to 45 percent gravel
 Calcium carbonate equivalent: 1 to 5 percent
 Reaction: pH 7.4 to 8.4

Nieman Series

Depth class: Shallow

Drainage class: Well drained

Permeability: Moderate

Landform: Ridges, structural benches, mountains, and foothills

Parent material: Residuum derived from gneiss and schist

Slope range: 2 to 65 percent

Elevation range: 6,200 to 8,500 feet

Annual precipitation: 15 to 19 inches

Annual air temperature: 34 to 38 degrees F

Frost-free period: 30 to 70 days

Taxonomic Class: Loamy-skeletal, mixed, superactive Lithic Argicryolls

Typical Pedon

Nieman cobbly loam, in an area of Barbarela-Nieman-Oro Fino complex, 2 to 15 percent slopes, in an area of rangeland, 1,550 feet south and 750 feet west of the northeast corner of sec. 16, T. 9 S., R. 6 W. Red Canyon topographic quadrangle (lat. 45°03'18"N; long. 112°20'14"W)

- A—0 to 5 inches; brown (10YR 5/3) cobbly loam, dark brown (10YR 3/3) moist; weak fine and medium subangular blocky structure parting to very fine and fine granular; soft, very friable, slightly sticky, slightly plastic; few fine and many very fine roots; 10 percent cobbles; 10 percent gravel; neutral; clear smooth boundary.
- Bt—5 to 11 inches; dark yellowish brown (10YR 4/4) very gravelly sandy clay loam, dark yellowish brown (10YR 3/4) moist; moderate very fine and fine subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; few fine and

common very fine roots; common faint patchy clay films between sand grains, few faint patchy clay films on faces of peds, and common faint patchy clay films on gravel; 5 percent cobbles; 40 percent gravel; neutral; clear smooth boundary.
 C—11 to 15 inches; yellowish brown (10YR 5/4) extremely gravelly loamy sand, dark yellowish brown (10YR 4/6) moist; single grain; loose, nonsticky, nonplastic; few very fine and fine roots; 65 percent gravel; neutral.
 R—15 inches; hard gneiss bedrock.

Range in Characteristics

Mean annual soil temperature: 36 to 40 degrees F

Moisture control section: Between 4 and 12 inches or between 4 inches and the lithic contact when bedrock is less than 12 inches

Thickness of the mollic epipedon: 7 to 11 inches

Depth to the argillic horizon: 5 to 7 inches

Depth to the lithic contact: 10 to 20 inches

A horizon

Value: 4 or 5 dry; 3 moist

Chroma: 2 or 3

Texture: Sandy loam or loam

Clay content: 10 to 20 percent

Content of rock fragments: 10 to 60 percent—0 to 25 percent cobbles; 10 to 35 percent gravel

Reaction: pH 6.6 to 7.3

Bt horizon

Hue: 10YR or 2.5Y

Value: 4 or 5 dry; 3 or 4 moist

Chroma: 3 or 4

Texture: Sandy loam or sandy clay loam

Clay content: 18 to 25 percent

Content of rock fragments: 35 to 75 percent—0 to 20 percent cobbles; 35 to 55 percent gravel

Reaction: pH 6.6 to 7.3

C horizon

Hue: 10YR or 2.5Y

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 3, 4, or 6

Texture: Loamy sand or sandy loam

Clay content: 5 to 18 percent

Content of rock fragments: 35 to 70 percent gravel

Reaction: pH 6.6 to 7.3

Nippt Series

Depth class: Very deep

Drainage class: Well drained

Permeability: Moderate to 19 inches and rapid below

Landform: Stream terraces and alluvial fans

Parent material: Alluvium

Slope range: 0 to 8 percent

Elevation range: 4,500 to 6,500 feet

Annual precipitation: 10 to 14 inches

Annual air temperature: 38 to 42 degrees F

Frost-free period: 70 to 105 days

Taxonomic Class: Sandy-skeletal, mixed, frigid Aridic Haplustalfs

Typical Pedon

Nippt gravelly sandy loam, in an area of Nippt-Scravo-Nippt complex, 0 to 4 percent slopes, in an area of rangeland, 450 feet south and 850 feet west of the northeast corner of sec. 14, T. 7 S., R. 10 W. Burns Mountain topographic quadrangle (lat. 45°13'50"N; long. 112°47'12"W)

A—0 to 4 inches; grayish brown (10YR 5/2) gravelly sandy loam, dark grayish brown (10YR 4/2) moist; weak very fine and fine subangular blocky structure parting to very fine and fine granular; soft, very friable, slightly sticky, nonplastic; few fine and many very fine roots; 5 percent cobbles; 15 percent gravel; neutral; clear smooth boundary.

Bt—4 to 9 inches; pale brown (10YR 6/3) gravelly sandy clay loam, brown (10YR 5/3) moist; moderate medium prismatic structure parting to strong fine and medium subangular blocky; hard, friable, moderately sticky, moderately plastic; few fine and many very fine roots; common faint patchy clay films between sand grains and few faint patchy clay films on faces of peds; 20 percent gravel; slightly alkaline; clear smooth boundary.

Bk1—9 to 19 inches; light gray (10YR 7/2) very gravelly sandy loam, light brownish gray (10YR 6/2) moist; moderate very fine and fine subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; few fine and common very fine roots; 10 percent cobbles; 35 percent gravel; disseminated lime; few fine soft masses of lime; continuous prominent carbonate coats on gravel; violently effervescent; moderately alkaline; clear wavy boundary.

2Bk2—19 to 60 inches; light gray (10YR 7/2) extremely gravelly sand, brown (10YR 5/3) moist; single grain; loose, nonsticky, nonplastic; 15 percent cobbles; 50 percent gravel; disseminated lime; continuous prominent lime casts on gravel; violently effervescent; moderately alkaline.

Range in Characteristics

Mean annual soil temperature: 40 to 47 degrees F

Moisture control section: Between 4 and 12 inches

Depth to the Bk horizon: 5 to 10 inches

Depth to the 2Bk2 horizon: 10 to 20 inches

A horizon

Value: 5 dry; 3 or 4 moist

Chroma: 2 or 3

Clay content: 10 to 25 percent

Texture: Sandy loam or loam

Content of rock fragments: 15 to 60 percent—0 to 30 percent cobbles; 15 to 30 percent gravel

Reaction: pH 6.6 to 7.8

Bt horizon

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 3 or 4

Texture: Sandy clay loam or loam

Clay content: 20 to 35 percent

Content of rock fragments: 20 to 60 percent—0 to 20 percent cobbles; 20 to 40 percent gravel

Reaction: pH 6.6 to 7.8

Bk1 horizon

Value: 6 to 8 dry; 4 to 6 moist

Chroma: 2 to 4

Texture: Sandy loam or loam

Clay content: 10 to 20 percent

Content of rock fragments: 35 to 70 percent—0 to 20 percent cobbles; 35 to 50 percent gravel

Calcium carbonate equivalent: 5 to 15 percent

Reaction: pH 7.9 to 8.4

2Bk2 horizon

Hue: 10YR or 2.5Y

Value: 6 or 7 dry; 4 to 6 moist

Chroma: 2 to 4

Texture: Sand or loamy sand

Clay content: 0 to 5 percent

Content of rock fragments: 35 to 80 percent—0 to 20 percent cobbles; 35 to 60 percent gravel

Calcium carbonate equivalent: 5 to 15 percent

Reaction: pH 7.4 to 9.0

Nuley Series

Depth class: Deep

Drainage class: Well drained

Permeability: Moderate in the upper 24 inches and rapid below

Landform: Hills and structural benches

Parent material: Gneiss colluvium

Slope range: 2 to 35 percent

Elevation range: 4,500 to 6,500 feet

Annual precipitation: 10 to 14 inches

Annual air temperature: 38 to 42 degrees F

Frost-free period: 90 to 105 days

Taxonomic Class: Fine-loamy, mixed, superactive, frigid Calcic Argiustolls

Typical Pedon

Nuley clay loam, 2 to 8 percent slopes, in an area of cropland, 2,000 feet west and 25 feet north of the southeast corner of sec. 16, T. 1 S., R. 1 W. Madison County, Montana.

A—0 to 7 inches; grayish brown (10YR 5/2) clay loam, dark brown (10YR 3/3) moist; weak and moderate fine granular structure; soft, friable, slightly sticky, slightly plastic; many fine roots; many fine tubular pores and few fine interstitial pores; 5 percent gravel; slightly alkaline; abrupt smooth boundary.

Bt—7 to 11 inches; brown (10YR 4/3) clay loam, dark yellowish brown (10YR 3/4) moist; moderate medium subangular blocky structure; slightly hard, friable, moderately sticky and moderately plastic; many fine roots; common fine tubular pores; common or many distinct clay films on faces of peds; 5 percent gravel; slightly alkaline; clear wavy boundary.

Bk1—11 to 15 inches; light gray (10YR 7/2) sandy clay loam, yellowish brown (10YR 5/4) moist; weak medium subangular blocky structure; soft, friable, slightly sticky, slightly plastic; common fine roots; few fine tubular pores and common fine interstitial pores; 5 percent gravel; disseminated lime; violently effervescent; moderately alkaline; abrupt smooth boundary.

- Bk2—15 to 24 inches; white (10YR 8/1) sandy loam, light gray (10YR 7/2) moist; massive; slightly hard, friable, nonsticky, nonplastic; common fine roots; common fine tubular pores; 5 percent gravel; disseminated lime; violently effervescent; moderately alkaline; abrupt smooth boundary.
- 2C—24 to 50 inches; grayish brown (2.5Y 5/2) gravelly coarse sand, dark grayish brown (2.5Y 4/2) moist; single grain; loose, nonsticky, nonplastic; very few very fine roots; common fine and medium interstitial pores; 25 percent gravel; strongly effervescent; moderately alkaline.
- R—50 inches; granitic gneiss.

Range in Characteristics

Mean annual soil temperature: 41 to 47 degrees F

Moisture control section: Between 4 and 12 inches

Depth to the Bk horizon: 10 to 15 inches

Depth to the lithic contact: 40 to 60 inches

A horizon

Hue: 7.5YR, 10YR, or 2.5Y

Value: 2 or 3 moist

Chroma: 2 or 3

Texture: Loam, sandy loam, or clay loam

Clay content: 15 to 35 percent

Content of rock fragments: 0 to 15 percent gravel

Reaction: pH 6.6 to 7.8

Bt horizon

Hue: 7.5YR, 10YR, or 2.5Y

Value: 4 or 5 dry; 2 to 4 moist

Chroma: 2 to 4

Texture: Clay loam or sandy clay loam

Clay content: 20 to 35 percent

Content of rock fragments: 0 to 15 percent gravel

Reaction: pH 6.6 to 7.8

Bk1 horizon

Hue: 7.5YR, 10YR, or 2.5Y

Value: 6 to 8 dry; 5 to 7 moist

Chroma: 1 to 4

Texture: Clay loam or sandy clay loam

Clay content: 20 to 35 percent

Content of rock fragments: 5 to 15 percent gravel

Calcium carbonate equivalent: 15 to 30 percent

Reaction: pH 6.6 to 8.4

Bk2 horizon

Hue: 7.5YR, 10YR, or 2.5Y

Value: 6 to 8 dry; 5 to 7 moist

Chroma: 1 to 4

Texture: Loam or sandy loam

Clay content: 5 to 15 percent

Content of rock fragments: 5 to 20 percent gravel

Calcium carbonate equivalent: 15 to 30 percent

Reaction: pH 7.4 to 8.4

2C horizon

Hue: 7.5YR, 10YR, or 2.5Y

Value: 4 to 6 dry; 3 to 5 moist

Chroma: 2 or 3
 Texture: Coarse sand or loamy coarse sand
 Clay content: 0 to 5 percent
 Content of rock fragments: 25 to 35 percent gravel
 Reaction: pH 7.4 to 8.4

Oro Fino Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderate to 50 inches and moderately rapid below
Landform: Hills and structural benches
Parent material: Colluvium or slope alluvium derived from gneiss and schist
Slope range: 2 to 45 percent
Elevation range: 6,100 to 7,800 feet
Annual precipitation: 15 to 19 inches
Annual air temperature: 34 to 38 degrees F
Frost-free period: 30 to 70 days

Taxonomic Class: Fine-loamy, mixed, superactive Ustic Argicryolls

Typical Pedon

Oro Fino loam, in an area of Barbarela-Nieman-Oro Fino complex, 2 to 15 percent slopes, in an area of rangeland, 2 300 feet east and 1,700 feet south of the northwest corner of sec. 9, T. 9 S., R. 6 W. Red Canyon topographic quadrangle (lat. 45°04'11"N; long. 112°20'42"W)

- A1—0 to 6 inches; brown (10YR 4/3) loam, very dark grayish brown (10YR 3/2) moist; weak very fine and fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine, fine, and medium roots; 10 percent gravel; neutral; clear smooth boundary.
 A2—6 to 11 inches; brown (10YR 5/3) gravelly loam, brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, moderately sticky, moderately plastic; many very fine and fine roots; 25 percent gravel; neutral; clear smooth boundary.
 Bt—11 to 25 inches; yellowish brown (10YR 5/4) gravelly clay loam, dark yellowish brown (10YR 4/4) moist; moderate coarse and very coarse prismatic structure; very hard, friable, moderately sticky, moderately plastic; many very fine and fine roots; many distinct clay films on faces of peds and in pores; 20 percent gravel; neutral; clear wavy boundary.
 Bk—25 to 50 inches; brownish yellow (10YR 6/6) gravelly sandy loam, yellowish brown (10YR 5/6) moist; weak medium and coarse subangular blocky structure; very hard, friable, moderately sticky, moderately plastic; few very fine and fine roots; 15 percent gravel; many soft masses of lime; strongly effervescent; moderately alkaline; abrupt wavy boundary.
 BC—50 to 60 inches; yellowish brown (10YR 5/6) gravelly loamy sand, dark yellowish brown (10YR 4/6) moist; massive; soft, very friable, nonsticky, nonplastic; 20 percent gravel; disseminated lime; very slightly effervescent; moderately alkaline.

Range in Characteristics

Mean annual soil temperature: 38 to 42 degrees F
Moisture control section: Between 4 and 12 inches

Thickness of the mollic epipedon: 7 to 15 inches

Depth to the Bk horizon: 15 to 30 inches

A horizons

Hue: 7.5YR or 10YR

Value: 3 to 5 dry; 2 to 4 moist

Chroma: 2 or 3

Clay content: 15 to 25 percent

Content of rock fragments: 10 to 30 percent gravel

Reaction: pH 6.6 to 7.8

Bt horizon

Hue: 7.5YR or 10YR

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 3 or 4

Texture: Sandy clay loam or clay loam

Clay content: 20 to 35 percent

Content of rock fragments: 15 to 35 percent gravel

Reaction: pH 6.6 to 7.8

Bk horizon

Hue: 7.5YR or 10YR

Value: 6 to 8 dry; 5 to 7 moist

Chroma: 2 to 4 or 6; 2 to 4 or 6

Texture: Loam or sandy loam

Clay content: 10 to 20 percent

Content of rock fragments: 15 to 45 percent gravel

Calcium carbonate equivalent: 5 to 15 percent

Reaction: pH 7.4 to 8.4

BC horizon

Hue: 7.5YR or 10YR

Value: 5 to 7 dry; 4 to 6 moist

Chroma: 2 to 4 or 6

Clay content: 5 to 10 percent

Content of rock fragments: 15 to 60 percent gravel

Calcium carbonate equivalent: 0 to 10 percent

Reaction: pH 7.4 to 8.4

Pensore Series

Depth class: Shallow

Drainage class: Well drained

Permeability: Moderate

Landform: Hills and strike ridges

Parent material: Residuum derived from limestone

Slope range: 4 to 45 percent

Elevation range: 5,200 to 5,600 feet

Annual precipitation: 10 to 14 inches

Annual air temperature: 38 to 42 degrees F

Frost-free period: 75 to 105 days

Taxonomic Class: Loamy-skeletal, carbonatic, frigid Lithic Calcustepts

Typical Pedon

Pensore channery loam, in an area of Pensore-Crago-Rock outcrop complex, 8 to 45 percent slopes, in an area of rangeland, 2,200 feet east and 1,200 feet south of the northwest corner of sec. 2, T. 6 S., R. 8 W. Block Mountain topographic quadrangle (lat. 45°26'05"N; long. 112°33'33"W)

A—0 to 3 inches; pale brown (10YR 6/3) channery loam, brown (10YR 4/3) moist; weak very fine and fine granular structure; soft, very friable, moderately sticky, moderately plastic; many very fine, fine, and medium roots; 30 percent channers; disseminated lime; violently effervescent; moderately alkaline; clear smooth boundary.

Bk—3 to 14 inches; very pale brown (10YR 7/3) very channery loam, pale brown (10YR 6/3) moist; weak medium subangular blocky structure; slightly hard, very friable, moderately sticky, moderately plastic; many very fine, fine, and medium roots; 55 percent channers; disseminated lime; continuous prominent lime casts on undersides of rock fragments; violently effervescent; moderately alkaline.

R—14 inches; hard limestone bedrock

Range in Characteristics

Mean annual soil temperature: 40 to 47 degrees F

Moisture control section: Between 4 and 12 inches or from 4 inches to the lithic contact

Depth to the lithic contact: 10 to 20 inches

A horizon

Value: 4 to 6 dry; 3 to 5 moist

Chroma: 1 to 4

Clay content: 15 to 25 percent

Content of rock fragments: 15 to 60 percent—0 to 15 percent stones or cobbles; 10 to 55 percent gravel or channers

Reaction: pH 7.9 to 8.4

Bk horizon

Value: 5 to 8 dry; 4 to 7 moist

Chroma: 2 or 3

Clay content: 15 to 25 percent

Content of rock fragments: 35 to 80 percent—0 to 20 percent stones or cobbles; 35 to 60 percent gravel or channers

Calcium carbonate equivalent: 40 to 60 percent, including rock fragments less than 3/4 inch in size

Reaction: pH 7.9 to 8.4

Perma Series

Depth class: Very deep

Drainage class: Somewhat excessively drained

Permeability: Moderate

Landform: Escarpments, ridges, and hills

Parent material: Slope alluvium and colluvium from mixed rock sources

Slope range: 15 to 60 percent

Elevation range: 5,500 to 6,500 feet

Annual precipitation: 15 to 19 inches

Annual air temperature: 36 to 40 degrees F

Frost-free period: 70 to 90 days

Taxonomic Class: Loamy-skeletal, mixed, superactive, frigid Typic Haplustolls

Typical Pedon

Perma cobbly loam, in an area of Perma, stony-Whitlash, very stony complex, 15 to 35 percent slopes, in an area of rangeland, 2,590 feet east and 1,520 feet north of the southwest corner of sec. 28, T. 7 N., R. 4 W. Jefferson County, Montana.

- A1—0 to 7 inches; dark grayish brown (10YR 4/2) cobbly loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; soft, very friable, slightly sticky, slightly plastic; many very fine and fine roots; 15 percent angular cobbles; 15 percent angular gravel; neutral; clear wavy boundary.
- A2—7 to 13 inches; brown (10YR 4/3) very gravelly loam, dark brown (10YR 3/3) moist; moderate medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine and fine roots; many very fine pores; 10 percent angular cobbles; 45 percent rounded gravel; neutral; clear wavy boundary.
- Bw1—13 to 28 inches; brown (10YR 5/3) very gravelly loam, brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine and fine roots; common very fine pores; 15 percent angular cobbles; 35 percent angular gravel; neutral; gradual wavy boundary.
- Bw2—28 to 44 inches; pale brown (10YR 6/3) very gravelly sandy loam, brown (10YR 4/3) moist; weak fine subangular blocky structure; slightly hard, very friable, nonsticky, nonplastic; common very fine and fine roots; common very fine pores; 15 percent angular cobbles; 40 percent angular gravel; slightly alkaline; gradual wavy boundary.
- BC—44 to 60 inches; very pale brown (10YR 7/3) extremely gravelly sandy loam, grayish brown (10YR 5/2) moist; massive; slightly hard, very friable, nonsticky, nonplastic; few very fine roots; 20 percent angular cobbles; 50 percent angular gravel; common faint carbonate coats on undersides of rock fragments; slightly alkaline.

Range in Characteristics

Mean annual soil temperature: 38 to 42 degrees F

Moisture control section: Between 8 and 24 inches

Thickness of the mollic epipedon: 10 to 15 inches

Surface stones or boulders: 0.01 to 3 percent

A horizons

Value: 4 or 5 dry; 2 or 3 moist

Chroma: 2 or 3

Clay content: 15 to 27 percent

Content of rock fragments: 15 to 60 percent—0 to 30 percent stones or cobbles;
10 to 50 percent gravel

Reaction: pH 6.1 to 7.3

Bw horizons

Hue: 7.5YR or 10YR

Value: 4 to 6 dry; 3 to 5 moist

Chroma: 2 to 4

Texture: Loam or sandy loam

Clay content: 10 to 20 percent

Content of rock fragments: 35 to 85 percent—0 to 50 percent stones or cobbles;
25 to 65 percent gravel

Reaction: pH 6.1 to 7.8

BC horizon

Hue: 7.5YR or 10YR

Value: 4, 6, or 7 dry; 3 to 5 moist

Chroma: 2 to 4

Texture: Loam or sandy loam

Clay content: 0 to 20 percent

Content of rock fragments: 60 to 85 percent—10 to 50 percent stones or cobbles;
50 to 65 percent gravel

Calcium carbonate equivalent: 0 to 10 percent

Reaction: pH 7.4 to 8.4

Philipsburg Series*Depth class:* Very deep*Drainage class:* Well drained*Permeability:* Moderately slow*Landform:* Alluvial fans, fan terraces, drainageways, moraines, and hillsides*Parent material:* Alluvium derived from mixed rock sources*Slope range:* 1 to 60 percent*Elevation range:* 6,200 to 8,000 feet*Annual precipitation:* 15 to 19 inches*Annual air temperature:* 34 to 38 degrees F*Frost-free period:* 30 to 70 days**Taxonomic Class:** Fine-loamy, mixed, superactive Ustic Argicryolls**Typical Pedon**

Philipsburg loam, 2 to 15 percent slopes, in an area of rangeland, 2,200 feet west and 1,500 feet north of the southeast corner of sec. 29, T. 10 S., R. 5 W. Swamp Creek topographic quadrangle (lat. 44°55'55"N; long. 112°14'24"W)

A1—0 to 4 inches; very dark grayish brown (10YR 3/2) loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure parting to moderate very fine and fine granular; soft, very friable, nonsticky, nonplastic; many very fine, fine, and medium roots; 5 percent gravel; slightly acid; clear smooth boundary.

A2—4 to 9 inches; very dark gray (10YR 3/1) silt loam, black (10YR 2/1) moist; moderate medium and coarse subangular blocky structure; hard, very friable, slightly sticky, nonplastic; many very fine, fine, and medium roots; 5 percent gravel; neutral; clear wavy boundary.

Bt1—9 to 14 inches; brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; strong medium and coarse subangular blocky structure; very hard, friable, moderately sticky, moderately plastic; many very fine and fine roots; common faint clay films on faces of peds; 5 percent gravel; slightly alkaline; clear wavy boundary.

Bt2—14 to 26 inches; light yellowish brown (10YR 6/4) clay loam, brown (10YR 4/3) moist; strong coarse prismatic structure; very hard, friable, moderately sticky, moderately plastic; many very fine and fine roots; continuous distinct clay films on faces of peds; 5 percent gravel; slightly alkaline; clear wavy boundary.

Bk1—26 to 36 inches; pale brown (10YR 6/3) gravelly loam, brown (10YR 5/3) moist; weak fine and medium subangular blocky structure; slightly hard, friable, moderately sticky, moderately plastic; common very fine and fine roots; 15 percent gravel; common fine soft masses of lime; common distinct carbonate coats on undersides of rock fragments; violently effervescent; moderately alkaline; gradual wavy boundary.

Bk2—36 to 60 inches; pale yellow (2.5Y 8/2) gravelly loam, pale yellow (2.5Y 7/3) moist; very hard, friable, slightly sticky, nonplastic; weak coarse subangular blocky structure; few very fine roots; 5 percent cobbles; 30 percent gravel; many medium and coarse soft masses of lime; common distinct carbonate coats on undersides of rock fragments; violently effervescent; moderately alkaline.

Range in Characteristics

Mean annual soil temperature: 36 to 40 degrees F

Moisture control section: Between 4 and 12 inches

Thickness of the mollic epipedon: 7 to 15 inches

Depth to the argillic horizon: 6 to 15 inches

Depth to the Bk horizon: 20 to 39 inches

A horizons

Value: 2 to 5 dry; 2 or 3 moist

Chroma: 1 or 2

Texture: Loam or silt loam

Clay content: 18 to 27 percent

Content of rock fragments: 0 to 30 percent—0 to 5 percent cobbles; 0 to 25 percent gravel

Reaction: pH 6.1 to 7.3

Bt horizons

Value: 4 to 6 dry; 3 to 5 moist

Chroma: 2 to 4

Texture: Loam or clay loam

Clay content: 25 to 35 percent

Content of rock fragments: 0 to 35 percent—0 to 10 percent cobbles; 0 to 35 percent gravel

Reaction: pH 7.4 to 7.8

Bk horizons

Hue: 10YR or 2.5Y

Value: 6 to 8 dry; 5 to 7 moist

Chroma: 2 to 4

Clay content: 18 to 27 percent

Content of rock fragments: 10 to 50 percent—0 to 15 percent cobbles; 10 to 35 percent gravel

Calcium carbonate equivalent: 15 to 25 percent

Reaction: pH 7.9 to 8.4

Poin Series

Depth class: Shallow

Drainage class: Well drained

Permeability: Moderately rapid

Landform: Hills, strike ridges, ridges, and mountain slopes

Parent material: Residuum derived from gneiss, schist, and sandstone

Slope range: 4 to 60 percent

Elevation range: 5,900 to 8,500 feet

Annual precipitation: 15 to 19 inches

Annual air temperature: 34 to 38 degrees F

Frost-free period: 30 to 70 days

Taxonomic Class: Loamy-skeletal, mixed, superactive Lithic Haplocryolls

Typical Pedon

Poin channery sandy loam, in an area of Poin, flaggy-Barbarela-Rock outcrop complex, 8 to 25 percent slopes, in an area of rangeland, 200 feet east and 800 feet north of the southwest corner of sec. 9, T. 9 S., R. 7 W. Elk Gulch topographic quadrangle (lat. 45°03'39"N; long. 112°28'36"W)

- A—0 to 7 inches; brown (10YR 5/3) channery sandy loam, dark brown (10YR 3/3) moist; moderate medium granular structure; soft, very friable, nonsticky, nonplastic; common medium and many very fine and fine roots; 5 percent flagstones; 20 percent channers; neutral; clear smooth boundary.
- Bw—7 to 14 inches; pale brown (10YR 6/3) very channery sandy loam, brown (10YR 4/3) moist; weak fine granular structure; soft, very friable, nonsticky, nonplastic; common medium and many very fine and fine roots; 35 percent channers; neutral; clear wavy boundary.
- C—14 to 18 inches; light yellowish brown (10YR 6/3) extremely channery sandy loam, olive brown (10YR 4/4) moist; massive; loose, nonsticky, nonplastic; few medium and many very fine and fine roots; 65 percent channers; neutral.
- R—18 inches; fractured gneiss and schist bedrock.

Range in Characteristics

Mean annual soil temperature: 36 to 40 degrees F

Moisture control section: Between 8 and 20 inches or between 8 inches and the lithic contact when bedrock is less than 20 inches

Thickness of the mollic epipedon: 7 to 10 inches

Depth to the lithic contact: 10 to 20 inches

A horizon

Value: 4 or 5 dry; 2 or 3 moist

Chroma: 2 or 3

Texture: Loam, sandy loam, or coarse sandy loam

Clay content: 5 to 15 percent

Content of rock fragments: 15 to 45 percent—5 to 15 percent flagstones or cobbles; 10 to 30 percent gravel or channers

Reaction: pH 6.1 to 7.4

Bw horizon

Value: 4 to 6 dry; 3 or 4 moist

Chroma: 2 or 3

Texture: Loam or sandy loam

Clay content: 5 to 18 percent

Content of rock fragments: 35 to 70 percent—0 to 20 percent flagstones or cobbles; 35 to 50 percent gravel or channers

Reaction: pH 6.1 to 7.4

C horizon

Hue: 10YR or 2.5Y

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 to 4

Texture: Sandy loam or loamy sand

Clay content: 5 to 12 percent

Content of rock fragments: 60 to 85 percent—0 to 15 percent flagstones or cobbles; 60 to 70 percent gravel or channers

Reaction: pH 6.1 to 7.4

Ratiopeak Series

Depth class: Very deep

Drainage class: Well drained

Permeability: Moderately slow

Landform: Hills, alluvial fans, and mountain slopes

Parent material: Alluvium or colluvium

Slope range: 4 to 45 percent

Elevation range: 6,200 to 8,000 feet

Annual precipitation: 15 to 19 inches

Annual air temperature: 34 to 38 degrees F

Frost-free period: 50 to 70 days

Taxonomic Class: Loamy-skeletal, mixed, superactive Ustic Argicryolls

Typical Pedon

Ratiopeak very cobbly loam, in an area of Ratiopeak, bouldery-Poin, flaggy complex, 15 to 45 percent slopes, in an area of rangeland, 1,500 feet north and 1,200 feet east of the southwest corner of sec. 6, T. 4 S., R. 9 W. Storm Peak topographic quadrangle (lat. 45°30'52"N; long. 112°46'08"W)

- A—0 to 8 inches; grayish brown (10YR 5/2) very cobbly loam, very dark grayish brown (10YR 3/2) moist; weak very fine and fine subangular blocky structure parting to weak very fine and fine granular; soft, very friable, slightly sticky, slightly plastic; few fine and medium and many very fine roots; 25 percent cobbles; 30 percent gravel; neutral; clear smooth boundary.
- Bt1—8 to 15 inches; light olive brown (2.5Y 5/3) extremely cobbly loam, dark olive brown (2.5Y 3/3) moist; moderate very fine and fine subangular blocky structure; slightly hard, friable, moderately sticky, slightly plastic; few fine and medium and common very fine roots; common faint patchy clay films on faces of peds and between sand grains; common faint continuous clay films on rock fragments; 30 percent cobbles; 35 percent gravel; neutral; clear smooth boundary.
- Bt2—15 to 25 inches; light olive brown (2.5Y 5/4) extremely cobbly sandy clay loam, olive brown (2.5Y 4/4) moist; moderate very fine and fine subangular blocky structure; slightly hard, friable, moderately sticky, slightly plastic; few fine and medium and common very fine roots; common faint patchy clay films on faces of peds, between sand grains, and on rock fragments; 25 percent cobbles; 40 percent gravel; neutral; clear wavy boundary.
- Bk—25 to 60 inches; light brownish gray (2.5Y 6/2) extremely cobbly sandy loam, light olive brown (2.5Y 5/3) moist; weak very fine and fine granular structure; soft, very friable, slightly sticky, nonplastic; few very fine and fine roots; 40 percent cobbles; 25 percent gravel; disseminated lime; few fine and medium soft masses of lime; common distinct lime casts on undersides of rock fragments; violently effervescent; moderately alkaline.

Range in Characteristics

Mean annual soil temperature: 38 to 42 degrees F

Moisture control section: Between 4 and 12 inches

Thickness of the mollic epipedon: 10 to 15 inches

Depth to the argillic horizon: 6 to 11 inches

Depth to the Bk horizon: 25 to 40 inches

Surface stones and boulders: 0 to 0.1 percent

A horizon

Value: 4 or 5 dry; 2 or 3 moist

Chroma: 1 to 3

Clay content: 18 to 27 percent

Content of rock fragments: 15 to 60 percent—0 to 30 percent cobbles; 15 to 30 percent gravel

Reaction: pH 6.6 to 7.3

Bt horizons

Hue: 10YR or 2.5Y

Value: 5 dry; 3 or 4 moist

Chroma: 2 to 4

Texture: Loam, clay loam, or sandy clay loam

Clay content: 25 to 35 percent

Content of rock fragments: 35 to 70 percent—0 to 30 percent cobbles; 35 to 40 percent gravel

Reaction: pH 6.6 to 7.8

Bk horizon

Hue: 10YR or 2.5Y

Value: 6 or 7 dry; 5 or 6 moist

Chroma: 2 to 4

Texture: Sandy loam, loam, or clay loam

Clay content: 15 to 30 percent

Content of rock fragments: 35 to 70 percent—15 to 40 percent cobbles; 20 to 30 percent gravel

Calcium carbonate equivalent: 5 to 15 percent

Reaction: pH 7.4 to 8.4

Rencot Series

Depth class: Shallow

Drainage class: Well drained

Permeability: Moderate

Landform: Hills, strike ridges, and ridges

Parent material: Residuum from igneous and sandstone bedrock

Slope range: 2 to 60 percent

Elevation range: 4,500 to 6,500 feet

Annual precipitation: 10 to 14 inches

Annual air temperature: 38 to 42 degrees F

Frost-free period: 70 to 105 days

Taxonomic Class: Loamy-skeletal, mixed, superactive, frigid Lithic Calcicusteps

Typical Pedon

Rencot very cobbly loam, in an area of Rencot, stony-Spudbar-Rock outcrop complex, 25 to 50 percent slopes, in an area of rangeland, 800 feet south and 2,600 feet east of the northwest corner of sec. 12, T. 7 S., R. 9 W. Dillon West topographic quadrangle (lat. 45°14'42"N; long. 112°39'08"W)

A—0 to 3 inches; grayish brown (10YR 5/2) very cobbly loam, dark grayish brown (10YR 4/2) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; few fine and many very fine roots; 10 percent cobbles; 25 percent gravel; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk1—3 to 9 inches; light brownish gray (10YR 6/2) very gravelly loam, dark grayish brown (10YR 4/2) moist; weak medium and coarse subangular blocky structure; hard, very friable, slightly sticky, slightly plastic; few fine and common very fine roots; 10 percent cobbles; 40 percent gravel; disseminated lime; few fine masses of lime; violently effervescent; moderately alkaline; clear wavy boundary.

Bk2—9 to 15 inches; very pale brown (10YR 7/3) extremely gravelly sandy loam; pale brown (10YR 6/3) moist; weak very fine and fine granular structure; slightly hard, very friable, slightly sticky, nonplastic; few fine and common very fine roots; 10 percent cobbles; 60 percent gravel; disseminated lime; common distinct continuous lime casts on undersides of rock fragments; violently effervescent; moderately alkaline; abrupt wavy boundary.

R—15 inches; hard igneous rock.

Range in Characteristics

Mean annual soil temperature: 40 to 44 degrees F

Moisture control section: Between 4 and 12 inches

Depth to the Bk horizon: 3 to 6 inches

Depth to the lithic contact: 10 to 20 inches

Surface stones: 0 to 3 percent

A horizon

Value: 4 to 7 dry; 3 to 5 moist

Chroma: 2 to 4

Texture: Loam or sandy loam

Clay content: 15 to 25 percent

Content of rock fragments: 10 to 60 percent—0 to 20 percent flagstones or cobbles; 10 to 40 percent gravel or channers

Reaction: pH 7.4 to 8.4

Bk1 horizon

Hue: 10YR or 2.5Y

Value: 6 to 8 dry; 4 to 7 moist

Chroma: 2 to 4

Texture: Loam or sandy loam

Clay content: 15 to 25 percent

Content of rock fragments: 35 to 70 percent—0 to 20 percent flagstones or cobbles; 35 to 50 percent gravel or channers

Calcium carbonate equivalent: 10 to 30 percent

Reaction: pH 7.9 to 8.4

Bk2 horizon

Value: 6 to 8 dry; 4 to 7 moist

Chroma: 2 to 4

Texture: Loam or sandy loam

Clay content: 15 to 25 percent

Content of rock fragments: 35 to 75 percent—0 to 15 percent flagstones or cobbles; 35 to 60 percent gravel or channers

Calcium carbonate equivalent: 15 to 40 percent

Reaction: pH 7.9 to 9.0

Rentsac Series

Depth class: Shallow

Drainage class: Well drained

Permeability: Moderate

Landform: Strike ridges, ridges, and hills

Parent material: Residuum derived from calcareous sandstone

Slope range: 4 to 45 percent

Elevation range: 4,900 to 5,300 feet

Annual precipitation: 10 to 14 inches

Annual air temperature: 38 to 42 degrees F

Frost-free period: 90 to 105 days

Taxonomic Class: Loamy-skeletal, mixed, superactive, frigid Lithic Calcicusteps

Typical Pedon

Rentsac channery sandy loam, in an area of Cabbart, very stony-Rentsac, bouldery-Rock outcrop complex, 15 to 45 percent slopes, in an area of rangeland, 2,200 feet east and 2 300 feet north of the southwest corner of sec. 21, T. 5 S., R. 7 W.

Beaverhead Rock topographic quadrangle (lat. 45°23'07"N; long. 112°28'35"W)

A—0 to 2 inches; pale brown (10YR 6/3) channery sandy loam, brown (10YR 4/3) moist; weak very fine and fine granular structure; soft, very friable, nonsticky, nonplastic; many very fine, fine, and medium roots; 10 percent gravel; 20 percent channers; disseminated lime; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk1—2 to 9 inches; brown (10YR 5/3) very channery sandy loam, brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; soft, very friable, nonsticky, nonplastic; common very fine roots; 25 percent gravel; 25 percent channers; disseminated lime; continuous distinct carbonate coats on undersides of rock fragments; violently effervescent; moderately alkaline; clear wavy boundary.

Bk2—9 to 18 inches; pale brown (10YR 6/3) extremely channery sandy loam, brown (10YR 5/3) moist; weak coarse subangular blocky structure; soft, very friable, nonsticky, nonplastic; few very fine roots; 30 percent gravel; 35 percent channers; disseminated lime; continuous distinct carbonate coats on undersides of rock fragments; violently effervescent; moderately alkaline.

R—18 inches; fractured calcareous sandstone.

Range in Characteristics

Mean annual soil temperature: 40 to 45 degrees F

Moisture control section: Between 8 inches and the lithic contact; dry in all parts between four-tenths and five-tenths of the cumulative days per year when the soil temperature at a depth of 20 inches is 41 degrees F or higher

Depth to the lithic contact: 10 to 20 inches

Surface stones and boulders: 0 to 3 percent

A horizon

Value: 5 or 6 dry; 3 or 4 moist

Chroma: 2 or 3

Clay content: 10 to 18 percent

Content of rock fragments: 10 to 60 percent gravel or channers

Calcium carbonate equivalent: 0 to 5 percent

Reaction: pH 7.4 to 8.4

Bk horizons

Value: 5 to 7 dry; 4 or 5 moist

Chroma: 2 to 4

Clay content: 10 to 18 percent

Content of rock fragments: 25 to 70 percent gravel or channers

Calcium carbonate equivalent: 5 to 15 percent

Reaction: pH 7.9 to 8.4

Riverrun Series

Depth class: Very deep

Drainage class: Moderately well drained

Permeability: Rapid

Landform: Flood plains and drainageways

Parent material: Alluvium

Slope range: 0 to 4 percent

Elevation range: 4,800 to 5,500 feet

Annual precipitation: 10 to 14 inches

Annual air temperature: 38 to 42 degrees F

Frost-free period: 70 to 105 days

Taxonomic Class: Sandy-skeletal, mixed, frigid Oxyaquic Ustifluvents

Typical Pedon

Riverrun loam, in an area of Dillon, saline-Dillon-Riverrun, saline complex, 0 to 4 percent slopes, in an area of rangeland, 1,950 feet north and 1,150 feet west of the southeast corner of sec. 16, T. 5 S., R. 9 W. Glen topographic quadrangle (lat. 45°23'54"N; long. 112°42'59"W)

Az—0 to 6 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak very fine and fine granular structure; soft, very friable, slightly sticky, slightly plastic; few fine and many very fine roots; few fine soft masses of salts; disseminated lime; violently effervescent; strongly alkaline; clear smooth boundary.

C1—6 to 12 inches; pale brown (10YR 6/3) extremely cobbly sandy loam, brown (10YR 5/3) moist; weak very fine and fine granular structure; soft, very friable, slightly sticky, slightly plastic; few fine and common very fine roots; 30 percent cobbles; 45 percent gravel; disseminated lime; strongly effervescent; moderately alkaline; clear wavy boundary.

C2—12 to 60 inches; pale yellow (2.5Y 7/3) extremely cobbly sand, light olive brown (2.5Y 5/3) moist; single grain; loose, nonsticky, nonplastic; few very fine roots; 30 percent cobbles; 45 percent gravel; disseminated lime; strongly effervescent; moderately alkaline.

Range in Characteristics

Mean annual soil temperature: 42 to 46 degrees F

Moisture control section: Between 12 and 36 inches; dry in all parts between four-tenths and five-tenths of the cumulative days per year when the soil temperature at a depth of 20 inches is 41 degrees F or higher

Depth to the seasonal high water table: 3.5 to 5 feet

Az horizon

Hue: 10YR or 2.5Y

Value: 6 or 7 dry; 4 or 5 moist

Chroma: 2 or 3

Texture: Sandy loam or loam

Clay content: 10 to 26 percent

Content of rock fragments: 0 to 50 percent—0 to 20 percent cobbles; 0 to 30 percent gravel

Calcium carbonate equivalent: 10 to 30 percent

Electrical conductivity: 4 to 27 mmhos/cm

Sodium adsorption ratio: >13

Reaction: pH 7.9 to 9.0

C1 horizon

Hue: 10YR or 2.5Y

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 or 3

Clay content: 2 to 15 percent

Content of rock fragments: 0 to 75 percent—0 to 30 percent cobbles; 0 to 45 percent gravel

Calcium carbonate equivalent: 5 to 15 percent

Electrical conductivity: 2 to 4 mmhos/cm

Sodium adsorption ratio: 5 to 13

Reaction: pH 7.9 to 9.0

C2 horizon

Hue: 10YR or 2.5Y

Value: 5 to 7 dry; 4 or 5 moist

Chroma: 2 or 3

Texture: Stratified sand, loamy sand, loamy coarse sand, or coarse sand

Clay content: 2 to 10 percent

Content of rock fragments: 35 to 80 percent—0 to 30 percent stones or cobbles; 35 to 70 percent gravel

Calcium carbonate equivalent: 2 to 15 percent

Electrical conductivity: 0 to 4 mmhos/cm

Sodium adsorption ratio: 0 to 5

Reaction: pH 7.4 to 8.4

Rivra Series

Depth class: Very deep

Drainage class: Well drained

Permeability: Rapid or very rapid

Landform: Flood plains, drainageways, and stream terraces

Parent material: Alluvium

Slope range: 0 to 4 percent

Elevation range: 4,800 to 7,000 feet

Annual precipitation: 10 to 14 inches

Annual air temperature: 38 to 42 degrees F

Frost-free period: 70 to 105 days

Taxonomic Class: Sandy-skeletal, mixed, frigid Aridic Ustifluvents

Typical Pedon

Rivra gravelly sandy loam, in an area of Dillon-Rivra-Beavrock complex, 0 to 4 percent slopes, in an area of grazeable woodland, 1,400 feet west and 1,200 feet south of the northeast corner of sec. 7, T. 7 S., R. 8 W. Dillon West topographic quadrangle (lat. 45°14'38"N; long. 112°37'34"W)

A—0 to 5 inches; grayish brown (10YR 5/2) gravelly sandy loam, dark grayish brown (10YR 4/2) moist; weak very fine and fine granular structure; soft, very friable, nonsticky, nonplastic; many very fine, fine, and medium roots; 5 percent cobbles; 20 percent gravel; disseminated lime; strongly effervescent; slightly alkaline; clear smooth boundary.

C1—5 to 19 inches; light brownish gray (10YR 6/2) very gravelly loamy coarse sand; grayish brown (10YR 5/2) moist; single grain; loose, nonsticky, nonplastic; many very fine, fine, and medium roots; 10 percent cobbles; 45 percent gravel; disseminated lime; strongly effervescent; slightly alkaline; gradual wavy boundary.

C2—19 to 60 inches; light brownish gray (10YR 6/2) extremely gravelly sand, dark grayish brown (10YR 4/2) moist; single grain; loose, nonsticky, nonplastic; 10 percent cobbles; 60 percent gravel; disseminated lime; slightly effervescent; slightly alkaline.

Range in Characteristics

Mean annual soil temperature: 40 to 45 degrees F

Moisture control section: Between 12 and 35 inches; dry in all parts between four-tenths and five-tenths of the cumulative days per year when the soil temperature at a depth of 20 inches is 41 degrees F or higher

Depth to the seasonal high water table: 0 to 4 feet sometime from April through July

A horizon

Hue: 10YR or 2.5Y

Value: 5 or 6 dry; 3 to 5 moist

Chroma: 2 or 3

Texture: Loam, sandy loam, or loamy sand

Clay content: 5 to 25 percent

Content of rock fragments: 0 to 60 percent—0 to 20 percent stones or cobbles; 0 to 50 percent gravel

Reaction: pH 6.6 to 8.4

C horizons

Hue: 10YR or 2.5Y

Value: 5 to 7 dry; 4 or 5 moist

Chroma: 2 to 4

Texture: Sand or loamy coarse sand

Clay content: 0 to 5 percent

Content of rock fragments: 55 to 80 percent—10 to 20 percent stones or cobbles; 45 to 60 percent gravel

Reaction: pH 7.4 to 8.4

Rominell Taxadjunct

Depth class: Very deep

Drainage class: Well drained

Permeability: Slow

Landform: Alluvial fans and treads on terraces

Parent material: Alluvium

Slope range: 0 to 4 percent

Elevation range: 4,800 to 5,200 feet

Annual precipitation: 10 to 14 inches

Annual air temperature: 38 to 42 degrees F

Frost-free period: 70 to 105 days

Taxonomic Class: Fine-loamy, mixed, superactive, frigid Aridic Leptic Natrustalfs

Typical Pedon

Rominell Taxadjunct loam, in an area of Rominell loam, 0 to 4 percent slopes, in an area of rangeland, 350 feet north and 250 feet west of the southeast corner of

sec. 22, T. 4 S., R. 9 W. Glen topographic quadrangle (lat. 45°28'03"N; long. 112°41'32"W)

- E1—0 to 2 inches; light gray (2.5Y 7/2) loam, grayish brown (2.5Y 5/2) moist; weak fine and medium subangular blocky structure parting to weak very fine and fine granular; soft, very friable, slightly sticky, slightly plastic; common fine and medium and many very fine roots; many unstained silt and sand grains; strongly effervescent; strongly alkaline; abrupt smooth boundary.
- E2—2 to 6 inches; light gray (10YR 7/2) loam, brown (10YR 5/3) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; hard, friable, slightly sticky, slightly plastic; common fine and medium and many very fine roots; many unstained silt and sand grains; slightly effervescent; very strongly alkaline; abrupt wavy boundary.
- Btn1—6 to 19 inches; pale brown (10YR 6/3) clay loam, brown (10YR 4/3) moist; strong medium prismatic structure parting to strong fine and medium subangular blocky; hard, friable, moderately sticky, slightly plastic; few fine and medium and common very fine roots; common fine patchy clay films on faces of ped and bridging sand grains; slightly effervescent; very strongly alkaline; clear wavy boundary.
- Btn2—19 to 26 inches; light yellowish brown (2.5Y 6/3) clay loam, light olive brown (2.5Y 5/3) moist; strong medium prismatic structure parting to strong fine and medium subangular blocky; hard, friable, moderately sticky, slightly plastic; few fine and medium and common very fine roots; few faint patchy clay films on faces of ped and bridging sand grains; 5 percent gravel; slightly effervescent; very strongly alkaline; clear wavy boundary.
- Bkn—26 to 38 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; strong medium prismatic structure parting to strong fine and medium subangular blocky; hard, friable, moderately sticky, slightly plastic; few very fine roots; disseminated lime; common fine and medium soft masses and threads of lime; strongly effervescent; strongly alkaline; clear wavy boundary.
- 2C1—38 to 47 inches; light brownish gray (2.5Y 6/2) loamy sand, grayish brown (2.5Y 5/2) moist; single grain; loose; few very fine roots; 10 percent gravel; disseminated lime; strongly effervescent; moderately alkaline; clear wavy boundary.
- 2C2—47 to 60 inches; pale yellow (2.5Y 8/2) loam, light brownish gray (2.5Y 6/2) moist; massive; slightly hard, friable, moderately sticky, slightly plastic; few very fine roots; disseminated lime; strongly effervescent; slightly alkaline.

Range in Characteristics

Mean annual soil temperature: 42 to 47 degrees F

Moisture control section: Between 4 and 12 inches

Depth to the argillic horizon: 3 to 6 inches

Depth to the natric horizon: 3 to 6 inches

Depth to the Bkn horizon: 16 to 26 inches

Depth to the 2C horizon: 33 to 56 inches

Note: Some pedons have a thin A or Ap horizon.

E horizons

Hue: 10YR or 2.5Y

Value: 7 or 8 dry; 5 or 6 moist

Chroma: 1 to 3

Texture: Loam or silty clay loam

Clay content: 15 to 30 percent

Content of rock fragments: 0 to 15 percent gravel

Calcium carbonate equivalent: Less than 5 percent

Electrical conductivity: 2 to 8 mmhos/cm
Sodium adsorption ratio: >13
Reaction: pH 8.5 to 9.6

Btn horizons

Hue: 10YR or 2.5Y
Value: 6 to 8 dry; 4 to 6 moist
Chroma: 1 to 3
Texture: Clay loam, silty clay loam, or sandy clay loam
Clay content: 27 to 35 percent
Content of rock fragments: 0 to 15 percent gravel
Calcium carbonate equivalent: Less than 5 percent
Electrical conductivity: 2 to 8 mmhos/cm
Sodium adsorption ratio: >13
Reaction: pH 8.5 to 9.6

Bkn horizon

Hue: 10YR or 2.5Y
Value: 6 to 8 dry; 4 to 6 moist
Chroma: 1 to 3
Texture: Loam, clay loam, or silty clay loam
Clay content: 20 to 30 percent
Content of rock fragments: 0 to 15 percent gravel
Calcium carbonate equivalent: 5 to 15 percent
Electrical conductivity: 0 to 2 mmhos/cm
Sodium adsorption ratio: >13
Reaction: pH 8.5 to 9.6

2C horizons

Hue: 10YR or 2.5Y
Value: 5 to 8 dry; 4 to 6 moist
Chroma: 2 or 3
Texture: Loamy sand, sandy loam, loam, or silt loam
Clay content: 5 to 25 percent
Content of rock fragments: 0 to 15 percent gravel
Calcium carbonate equivalent: 5 to 10 percent
Electrical conductivity: 0 to 2 mmhos/cm
Sodium adsorption ratio: <13
Reaction: pH 7.4 to 8.4

Roto Series

Depth class: Moderately deep
Drainage class: Well drained
Permeability: Moderate to moderately rapid
Landform: Structural benches
Parent material: Alluvium over residuum derived from limestone
Slope range: 4 to 15 percent
Elevation range: 4,500 to 6,500 feet
Annual precipitation: 10 to 14 inches
Annual air temperature: 38 to 42 degrees F
Frost-free period: 70 to 105 days

Taxonomic Class: Loamy-skeletal, carbonatic, frigid Aridic Calcustepts

Typical Pedon

Roto gravelly loam, in an area of Musselshell-Roto-Pensore complex, 4 to 15 percent slopes, in an area of rangeland, 150 feet south and 1,650 feet west of the northeast corner of sec. 29, T. 7 S., R. 9 W. Dillon West topographic quadrangle (lat. 45°12'10"N; long. 112°43'44"W)

- A—0 to 4 inches; pale brown (10YR 6/3) gravelly loam, brown (10YR 4/3) moist; weak fine and medium subangular blocky structure parting to weak very fine and fine granular; soft, very friable, slightly sticky, slightly plastic; few fine and many very fine roots; 15 percent gravel; disseminated lime; strongly effervescent; moderately alkaline; clear smooth boundary.
- Bk1—4 to 12 inches; very pale brown (10YR 7/3) very gravelly loam, brown (10YR 5/3) moist; weak fine and medium subangular blocky structure parting to weak very fine and fine granular; soft, very friable, slightly sticky, slightly plastic; few fine and many very fine roots; 35 percent angular gravel; disseminated lime; few distinct carbonate coats on rock fragments; few fine and medium soft masses of lime; violently effervescent; moderately alkaline; clear smooth boundary.
- Bk2—12 to 19 inches; very pale brown (10YR 8/3) very gravelly loam, pale brown (10YR 6/3) moist; weak fine and medium subangular blocky structure parting to weak very fine and fine granular; soft, very friable, slightly sticky, nonplastic; few fine and common very fine roots; 5 percent angular cobbles; 35 percent angular gravel; disseminated lime; common distinct carbonate coats on rock fragments; few fine and medium soft masses of lime; violently effervescent; moderately alkaline; clear smooth boundary.
- Bk3—19 to 35 inches; very pale brown (10YR 8/3) very gravelly loam, light yellowish brown (10YR 6/4) moist; weak very fine and fine granular structure; soft, very friable, slightly sticky, nonplastic; few very fine and fine roots; 5 percent angular cobbles; 40 percent angular gravel; disseminated lime; many distinct continuous lime casts on undersides of rock fragments; common fine and medium soft masses of lime; violently effervescent; moderately alkaline; abrupt smooth boundary.
- R—35 inches; hard limestone.

Range in Characteristics

Mean annual soil temperature: 40 to 47 degrees F

Moisture control section: Between 4 and 12 inches

Depth to the calcic horizon: 2 to 5 inches

Depth to the lithic contact: 20 to 40 inches to limestone bedrock

A horizon

Hue: 10YR or 2.5Y

Value: 4 to 6 dry; 3 or 4 moist

Chroma: 1 to 3

Clay content: 10 to 25 percent

Content of rock fragments: 10 to 35 percent—0 to 10 percent stones or cobbles;
10 to 25 percent gravel

Calcium carbonate equivalent: 10 to 25 percent

Reaction: pH 7.9 to 8.4

Bk horizons

Hue: 10YR or 2.5Y

Value: 5 to 8 dry; 4 to 7 moist

Chroma: 2 to 4

Clay content: 10 to 27 percent

Content of rock fragments: 35 to 65 percent—5 to 10 percent cobbles; 30 to 55 percent gravel
 Calcium carbonate equivalent: 40 to 60 percent including rock fragments less than 20 mm
 Reaction: pH 7.9 to 9.0

Roxal Series

Depth class: Shallow
Drainage class: Well drained
Permeability: Moderate
Landform: Escarpments and hillsides
Parent material: Residuum from siltstone and sandstone
Slope range: 15 to 45 percent
Elevation range: 6,600 to 7,800 feet
Annual precipitation: 15 to 19 inches
Annual air temperature: 34 to 38 degrees F
Frost-free period: 30 to 70 days

Taxonomic Class: Loamy, mixed, superactive, calcareous, shallow Typic Cryorthents

Typical Pedon

Roxal loam, in an area of Tiban-Philipsburg-Roxal complex, 15 to 45 percent slopes, in an area of rangeland, 1,200 feet west and 300 feet south of the northeast corner of sec. 4, T. 10 S., R. 5 W. Swamp Creek topographic quadrangle (lat. 44°59'59"N; long. 112°12'56"W)

- A—0 to 4 inches; light brownish gray (2.5Y 6/2) loam, grayish brown (2.5Y 5/2) moist; weak very fine and fine granular structure; soft, very friable, slightly sticky, nonplastic; many very fine, fine, and medium roots; 5 percent gravel; violently effervescent; disseminated lime; moderately alkaline; clear smooth boundary.
- C1—4 to 11 inches; light yellowish brown (2.5Y 6/3) silt loam, light olive brown (2.5Y 5/3) moist; massive; slightly hard, very friable, slightly sticky, nonplastic; many very fine and fine roots; violently effervescent; disseminated lime; moderately alkaline; clear smooth boundary.
- C2—11 to 18 inches; pale yellow (2.5Y 8/2) silt loam, light yellowish brown (2.5Y 6/3) moist; massive; hard, very friable, moderately sticky, moderately plastic; common very fine and fine roots; 10 percent soft shale fragments; violently effervescent; disseminated lime; moderately alkaline; clear wavy boundary.
- Cr—18 to 60 inches; calcareous; interbedded siltstone, sandstone, and shale.

Range in Characteristics

Mean annual soil temperature: 36 to 40 degrees F
Moisture control section: Between 4 and 12 inches
Depth to the Cr horizon: 12 to 20 inches
Surface gravel and cobbles: 0 to 35 percent hard fragments

A horizon

Value: 5 or 6 dry; 4 or 5 moist
 Chroma: 2 or 3
 Clay content: 15 to 27 percent
 Content of rock fragments: 0 to 15 percent gravel
 Calcium carbonate equivalent: 1 to 10 percent
 Reaction: pH 7.4 to 8.4

C horizons

Value: 6 to 8 dry; 5 or 6 moist

Chroma: 2 or 3

Clay content: 18 to 27 percent

Content of rock fragments: 0 to 35 percent soft siltstone or shale

Calcium carbonate equivalent: 5 to 25 percent

Reaction: pH 7.9 to 8.4

Ryell Series

Depth class: Very deep

Drainage class: Well drained

Permeability: Moderate above, and rapid in, the 2C3 horizon

Landform: Flood plains and stream terraces

Parent material: Alluvium derived from mixed rock sources

Slope range: 0 to 4 percent

Elevation range: 4,800 to 6,000 feet

Annual precipitation: 10 to 14 inches

Annual air temperature: 38 to 42 degrees F

Frost-free period: 90 to 105 days

Taxonomic Class: Coarse-loamy over sandy or sandy-skeletal, mixed, superactive, calcareous, frigid Aridic Ustifluvents

Typical Pedon

Ryell loam, in an area of Ryell-Rivra complex, 0 to 4 percent slopes, in an area of cropland, 1,700 feet east and 1,700 feet north of the southwest corner of sec. 33, T. 8 S., R. 8 W. Ashbough Canyon topographic quadrangle (lat. 45°05'30"N; long. 112°35'36"W)

- A—0 to 3 inches; grayish brown (10YR 5/2) loam, brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; few medium and coarse and many very fine and fine roots; disseminated lime; strongly effervescent; moderately alkaline; clear smooth boundary.
- C1—3 to 11 inches; light brownish gray (10YR 6/2) loam with thin strata of fine sandy loam and sandy loam, dark grayish brown (10YR 4/2) moist; massive; hard, very friable, slightly sticky, slightly plastic; few medium and coarse and many very fine and fine roots; 5 percent gravel; disseminated lime; strongly effervescent; moderately alkaline; clear wavy boundary.
- C2—11 to 22 inches; light brownish gray (10YR 6/2) sandy loam with thin strata of loam and fine sandy loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable, nonsticky, nonplastic; few medium and many very fine and fine roots; 10 percent gravel; disseminated lime; violently effervescent; moderately alkaline; clear wavy boundary.
- 2C3—22 to 60 inches; light brownish gray (10YR 6/2) extremely gravelly loamy sand, dark grayish brown (10YR 4/2) moist; single grain; loose; 5 percent cobbles; 65 percent gravel; disseminated lime; strongly effervescent; moderately alkaline.

Range in Characteristics

Mean annual soil temperature: 40 to 44 degrees F

Moisture control section: Between 8 and 24 inches; dry in all parts between four-tenths and five-tenths of the cumulative days per year when the soil temperature at a depth of 20 inches is 41 degrees F or higher

Depth to the 2C3 horizon: 18 to 34 inches

A horizon

Hue: 10YR or 2.5Y

Value: 4 to 6 dry; 3 to 5 moist

Chroma: 2 or 3

Clay content: 15 to 25 percent

Content of rock fragments: 0 to 15 percent gravel

Calcium carbonate equivalent: 5 to 10 percent

Reaction: pH 7.4 to 8.4

C horizons

Hue: 10YR or 2.5Y

Value: 5 to 7 dry; 4 to 6 moist

Chroma: 2 or 3

Texture: Stratified loam or sandy loam

Clay content: 10 to 18 percent

Content of rock fragments: 0 to 15 percent gravel

Calcium carbonate equivalent: 5 to 15 percent

Reaction: pH 7.9 to 8.4

2C3 horizon

Hue: 10YR or 2.5Y

Value: 6 or 7 dry; 4 to 6 moist

Chroma: 2 or 3

Texture: Sand or loamy sand

Clay content: 0 to 10 percent

Content of rock fragments: 35 to 75 percent—0 to 10 percent cobbles; 35 to 65 percent gravel

Calcium carbonate equivalent: 1 to 10 percent

Reaction: pH 7.3 to 8.4

Sappington Series

Depth class: Very deep

Drainage class: Well drained

Permeability: Moderate

Landform: Alluvial fans, hills, swales, and terraces

Parent material: Calcareous alluvium or glacial outwash

Slope range: 0 to 25 percent

Elevation range: 4,800 to 6,500 feet

Annual precipitation: 10 to 14 inches

Annual air temperature: 38 to 42 degrees F

Frost-free period: 70 to 105 days

Taxonomic Class: Coarse-loamy, mixed, superactive, frigid Calcic Argiustolls

Typical Pedon

Sappington sandy clay loam, in an area of Varney-Sappington complex, 2 to 8 percent slopes, in an area of rangeland, 800 feet south and 1,300 feet east of

the northwest corner of sec. 22, T. 7 S., R. 8 W. Dillon East topographic quadrangle (lat. 45°12'58"N; long. 112°34'30"W)

- A—0 to 5 inches; brown (10YR 5/3) sandy clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium subangular blocky structure; very hard, firm, moderately sticky, moderately plastic; common very fine, fine, and medium roots; neutral; abrupt smooth boundary.
- Bt—5 to 9 inches; yellowish brown (10YR 5/4) clay loam, brown (10YR 4/3) moist; strong medium and coarse prismatic structure; extremely hard, firm, moderately sticky, moderately plastic; common very fine, fine, and medium roots; common distinct clay films on faces of peds; slightly alkaline; clear wavy boundary.
- Bk1—9 to 24 inches; very pale brown (10YR 7/3) loam, brown (10YR 5/3) moist; weak coarse subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine and fine roots; 5 percent gravel; common fine soft masses of lime; violently effervescent; moderately alkaline; clear wavy boundary.
- Bk2—24 to 44 inches; light yellowish brown (10YR 6/4) sandy loam, yellowish brown (10YR 5/4) moist; weak medium and coarse subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; few very fine roots; 5 percent gravel; few fine soft masses of lime; violently effervescent; moderately alkaline; clear wavy boundary.
- Bk3—44 to 60 inches; very pale brown (10YR 7/3) sandy loam, yellowish brown (10YR 5/4) moist; massive; soft, very friable, nonsticky, nonplastic; 5 percent gravel; disseminated lime; strongly effervescent; moderately alkaline.

Range in Characteristics

Mean annual soil temperature: 40 to 47 degrees F

Moisture control section: Between 8 and 24 inches; dry in all parts between four-tenths and five-tenths of the cumulative days per year when the soil temperature at a depth of 20 inches is 41 degrees F or higher

Thickness of the mollic epipedon: 7 inches, when mixed

Depth to the Bk horizon: 7 to 10 inches

Surface stones and boulders: 0 to 0.1 percent

A horizon

Value: 4 or 5 dry

Chroma: 2 or 3

Texture: Loam, clay loam, sandy clay loam, or sandy loam

Clay content: 15 to 35 percent

Content of rock fragments: 0 to 35 percent—0 to 10 percent cobbles; 0 to 25 percent gravel

Reaction: pH 6.6 to 7.8

Bt horizon

Hue: 10YR or 2.5Y

Value: 4 or 5 dry; 3 or 4 moist

Chroma: 3 or 4

Texture: Loam, clay loam, or sandy clay loam

Clay content: 20 to 35 percent

Content of rock fragments: 0 to 25 percent gravel

Reaction: pH 6.6 to 7.8

Bk1 and Bk2 horizons

Hue: 10YR or 2.5Y

Value: 6 or 7 dry; 5 or 6 moist

Chroma: 2 to 4

Texture: Loam or sandy loam
Clay content: 10 to 18 percent
Content of rock fragments: 0 to 25 percent gravel
Calcium carbonate equivalent: 15 to 40 percent
Reaction: pH 7.9 to 8.4

Bk3 horizon

Hue: 10YR or 2.5Y
Value: 6 or 7 dry; 5 or 6 moist
Chroma: 2 to 4
Clay content: 10 to 18 percent
Content of rock fragments: 0 to 25 percent gravel
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.9 to 8.4

Scravo Series

Depth class: Very deep

Drainage class: Well drained

Permeability: Moderately rapid to 12 inches and rapid below

Landform: Alluvial fans, terraces, hillsides, drainageways, and escarpments

Parent material: Calcareous alluvium

Slope range: 0 to 45 percent

Elevation range: 4,500 to 6,500 feet

Annual precipitation: 10 to 14 inches

Annual air temperature: 38 to 42 degrees F

Frost-free period: 70 to 105 days

Taxonomic Class: Sandy-skeletal, mixed, frigid Aridic Calcustepts

Typical Pedon

Scravo gravelly loam, in an area of Thessvo-Scravo complex, 0 to 4 percent slopes, in an area of cropland, 550 feet north and 1,450 feet west of the southeast corner of sec. 10, T. 8 S., R. 9 W. Dillon West topographic quadrangle (lat. 45°08'47"N; long. 112°41'17"W)

Ap—0 to 5 inches; light brownish gray (10YR 6/2) gravelly loam, dark grayish brown (10YR 4/2) moist; moderate fine and medium subangular blocky structure parting to moderate very fine and fine granular; slightly hard, friable, slightly sticky, slightly plastic; few fine and many very fine roots; 20 percent gravel; disseminated lime; violently effervescent; slightly alkaline; clear smooth boundary.

Bk1—5 to 10 inches; light brownish gray (10YR 6/2) very gravelly loam, grayish brown (10YR 5/2) moist; weak very fine subangular blocky structure parting to weak very fine and fine granular; soft, very friable, slightly sticky, slightly plastic; few fine and common very fine roots; 5 percent cobbles; 35 percent gravel; disseminated lime; few fine soft masses of lime; continuous prominent carbonate coats on gravel; violently effervescent; moderately alkaline; clear smooth boundary.

2Bk2—10 to 30 inches; pale brown (10YR 6/3) extremely gravelly sand, brown (10YR 5/3) moist; single grain; loose, nonsticky, nonplastic; few very fine roots; 10 percent cobbles; 60 percent gravel; disseminated lime; many prominent lime casts on undersides of rock fragments; violently effervescent; slightly alkaline; clear wavy boundary.

2Bk3—30 to 60 inches; light brownish gray (2.5Y 6/2) extremely gravelly sand, grayish brown (2.5Y 5/2) moist; single grain; loose, nonsticky, nonplastic; 20 percent cobbles; 60 percent gravel; disseminated lime; common prominent lime casts on undersides of rock fragments; strongly effervescent; slightly alkaline.

Range in Characteristics

Mean annual soil temperature: 40 to 47 degrees F

Moisture control section: Between 12 and 35 inches; dry in all parts between four-tenths and five-tenths of the cumulative days per year when the soil temperature at a depth of 20 inches is 41 degrees F or higher

Depth to the Bk horizon: 3 to 6 inches

Depth to the 2Bk horizon: 9 to 20 inches

Ap horizon

Hue: 10YR or 2.5Y

Value: 5 to 7 dry; 4 to 6 moist

Chroma: 2 or 3

Texture: Loam or sandy loam

Clay content: 10 to 25 percent

Content of rock fragments: 0 to 60 percent—0 to 30 percent cobbles; 0 to 30 percent gravel

Calcium carbonate equivalent: 1 to 15 percent

Reaction: pH 7.4 to 7.8

Bk1 horizon

Hue: 10YR or 2.5Y

Value: 6 to 8 dry; 4 to 6 moist

Chroma: 2 or 3

Texture: Sandy loam or loam

Clay content: 10 to 25 percent

Content of rock fragments: 35 to 70 percent—0 to 15 percent cobbles; 35 to 55 percent gravel

Calcium carbonate equivalent: 15 to 40 percent

Reaction: pH 7.9 to 8.4

2Bk horizons

Hue: 10YR or 2.5Y

Value: 6 to 8 dry; 4 to 6 moist

Chroma: 2 or 3

Texture: Loamy sand or sand

Clay content: 0 to 10 percent

Content of rock fragments: 35 to 80 percent—0 to 20 percent cobbles; 35 to 60 percent gravel

Electrical conductivity: 0 to 2 mmhos/cm

Calcium carbonate equivalent: 10 to 30 percent

Reaction: pH 7.4 to 8.4

Sebud Series

Depth class: Very deep

Drainage class: Well drained

Permeability: Moderate

Landform: Alluvial fans and mountains

Parent material: Slope alluvium and colluvium mainly from igneous and metamorphic rock

Slope range: 4 to 60 percent

Elevation range: 5,500 to 8,000 feet

Annual precipitation: 15 to 28 inches

Annual air temperature: 34 to 44 degrees F

Frost-free period: 30 to 70 days

Taxonomic Class: Loamy-skeletal, mixed, superactive Ustic Haplocryolls

Typical Pedon

Sebud very gravelly loam, in an area of Sebud, stony-Surdal, stony-Arrowpeak, very stony complex, 35 to 60 percent slopes, in an area of rangeland, 300 feet west and 800 feet north of the southeast corner of sec. 13, T. 3 N., R. 4 W. Jefferson County, Montana.

A—0 to 10 inches; very dark grayish brown (10YR 3/2) very gravelly loam, very dark brown (10YR 2/2) moist; moderate medium granular structure; soft, very friable, slightly sticky, nonplastic; many very fine and fine roots; 10 percent rounded cobbles; 25 percent rounded gravel; slightly acid; clear wavy boundary.

Bw1—10 to 23 inches; yellowish brown (10YR 5/4) very gravelly loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; many very fine and fine roots, few medium roots; many very fine and fine pores; 10 percent rounded cobbles; 30 percent rounded gravel; neutral; clear wavy boundary.

Bw2—23 to 32 inches; brown (10YR 5/3) very gravelly loam, dark grayish brown (10YR 4/2) moist; moderate medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine and fine roots, few medium and coarse roots; many very fine and fine pores; 10 percent rounded cobbles; 35 percent rounded gravel; neutral; gradual wavy boundary.

BC—32 to 44 inches; brown (10YR 5/3) very gravelly loam, brown (10YR 4/3) moist; moderate medium and coarse subangular blocky structure; slightly hard, very friable, slightly sticky, nonplastic; common very fine and fine roots, few medium and coarse roots; many very fine and fine pores; 20 percent rounded cobbles; 40 percent rounded gravel; neutral; gradual irregular boundary.

C—44 to 60 inches; brown (10YR 5/3) extremely gravelly loam, grayish brown (10YR 5/2) moist; massive; slightly hard, very friable, nonsticky, nonplastic; few very fine and fine roots; few very fine and fine pores; 10 percent rounded cobbles; 60 percent rounded gravel; neutral.

Range in Characteristic

Mean annual soil temperature: 36 to 42 degrees F

Moisture control section: Between 6 and 18 inches

Thickness of the mollic epipedon: 10 to 16 inches

Surface stones and boulders: 0 to 3 percent

A horizon

Hue: 10YR or 2.5Y

Value: 3 or 4 dry; 2 or 3 moist

Chroma: 1 to 3

Clay content: 15 to 27 percent

Content of rock fragments: 10 to 60 percent—5 to 45 percent cobbles; 5 to 25 percent gravel

Reaction: pH 6.1 to 7.8

Bw horizons

Hue: 10YR or 2.5Y

Value: 5 to 7 dry; 3 to 5 moist

Chroma: 2 to 4

Texture: Loam or sandy clay loam

Clay content: 12 to 27 percent

Content of rock fragments: 35 to 60 percent—10 to 20 percent cobbles; 25 to 40 percent gravel

Reaction: pH 6.6 to 7.8

BC horizon

Hue: 10YR or 2.5Y

Value: 5 to 7 dry; 3 to 5 moist

Chroma: 2 to 4

Texture: Loam or sandy clay loam

Clay content: 12 to 27 percent

Content of rock fragments: 35 to 60 percent—10 to 20 percent cobbles; 25 to 40 percent gravel

Reaction: pH 6.6 to 7.8

C horizon

Hue: 10YR or 2.5Y

Value: 5 to 7 dry; 3 to 5 moist

Chroma: 2 to 4

Texture: Loam or sandy clay loam

Clay content: 12 to 27 percent

Content of rock fragments: 35 to 85 percent—10 to 25 percent cobbles; 25 to 60 percent gravel

Reaction: pH 6.6 to 7.8

Shadow Series*Depth class:* Very deep*Drainage class:* Somewhat excessively drained*Permeability:* Moderately rapid*Landform:* Mountain slopes*Parent material:* Colluvium derived from gneiss and schist*Slope range:* 15 to 70 percent*Elevation range:* 6,300 to 8,100 feet*Annual precipitation:* 15 to 30 inches*Annual air temperature:* 34 to 38 degrees F*Frost-free period:* 30 to 70 days**Taxonomic Class:** Loamy-skeletal, mixed, superactive Ustic Eutrocrypts**Typical Pedon**

Shadow very channery loam, very stony, in an area of Shadow complex, 15 to 70 percent slopes, in an area of woodland, 900 feet west and 1,000 feet north of the southeast corner of sec. 30, T. 8 S., R. 7 W. Ashbough Canyon topographic quadrangle (lat. 45°06'21"N; long. 112°30'04"W)

Oe—0 to 1 inch; partially decomposed forest litter.

A—1 to 4 inches; grayish brown (10YR 5/2) very channery loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; soft, very friable, nonsticky, nonplastic; few coarse, common very fine and fine, and many medium

roots; 25 percent gravel; 15 percent channers; medium acid; clear smooth boundary.

E—4 to 12 inches; light brownish gray (10YR 6/2) very channery loam, dark grayish brown (10YR 4/2) moist; weak fine subangular blocky structure parting to moderate medium granular; slightly hard, very friable, nonsticky, nonplastic; few coarse, common very fine and fine, and many medium roots; 25 percent gravel; 20 percent channers; slightly acid; clear smooth boundary.

Bw—12 to 29 inches; pale brown (10YR 6/3) very channery sandy loam, brown (10YR 4/3) moist; weak fine subangular blocky structure; slightly hard, very friable, nonsticky, nonplastic; few very fine and fine, many medium, and few coarse roots; 30 percent gravel; 20 percent channers; medium acid; gradual wavy boundary.

BC—29 to 60 inches; pale brown (10YR 6/3) extremely channery sandy loam, brown (10YR 4/3) moist; massive; loose; few fine and medium roots; 50 percent gravel; 15 percent channers; slightly acid.

Range in Characteristics

Mean annual soil temperature: 36 to 40 degrees F

Moisture control section: Between 8 and 24 inches

Surface stones: 0 to 3 percent

A horizon

Value: 5 or 6 dry; 3 or 4 moist

Chroma: 2 or 3

Clay content: 5 to 15 percent

Content of rock fragments: 10 to 60 percent gravel or channers

Reaction: pH 5.6 to 7.3

E horizon

Value: 5 to 7 dry; 4 or 5 moist

Chroma: 2 to 4

Texture: Sandy loam or loam

Clay content: 5 to 15 percent

Content of rock fragments: 40 to 60 percent gravel or channers

Reaction: pH 5.6 to 7.3

Bw horizon

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 or 3

Clay content: 5 to 15 percent

Content of rock fragments: 35 to 70 percent gravel or channers

Reaction: pH 5.6 to 7.3

BC horizon

Value: 5 to 7 dry; 4 or 5 moist

Chroma: 2 to 4

Clay content: 5 to 15 percent

Content of rock fragments: 60 to 75 percent gravel or channers

Reaction: pH 5.6 to 7.3

Sieberell Series

Depth class: Very deep

Drainage class: Well drained

Permeability: Moderate to 21 inches and rapid in the 2C horizon

Landform: Alluvial fans

Parent material: Alluvium

Slope range: 1 to 4 percent

Elevation range: 5,800 to 6,300 feet

Annual precipitation: 10 to 14 inches

Annual air temperature: 38 to 42 degrees F

Frost-free period: 70 to 90 days

Taxonomic Class: Loamy-skeletal over sandy or sandy-skeletal, mixed, superactive, frigid Aridic Argiustolls

Typical Pedon

Sieberell cobbly loam, in an area of Beavwan-Sieberell complex, 1 to 4 percent slopes, in an area of rangeland, 1,500 feet east and 1,300 feet south of the northwest corner of sec. 24, T. 10 S., R. 7 W. Price Creek topographic quadrangle (lat. 44°57'10"N; long. 112°24'39"W)

- A—0 to 5 inches; grayish brown (10YR 5/2) cobbly loam, dark brown (10YR 3/3) moist; weak fine and medium subangular blocky structure parting to weak very fine and fine granular; soft, very friable, slightly sticky, slightly plastic; few fine and many very fine roots; 10 percent cobbles; 15 percent gravel; neutral; clear smooth boundary.
- Bt—5 to 11 inches; yellowish brown (10YR 5/4) very gravelly clay loam, dark yellowish brown (10YR 4/4) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; slightly hard, friable, moderately sticky, slightly plastic; few fine and many very fine roots; many distinct clay films on faces of peds; 10 percent cobbles; 35 percent gravel; neutral; clear smooth boundary.
- Bk—11 to 21 inches; light gray (10YR 7/2) extremely gravelly sandy loam, brown (10YR 5/3) moist; weak very fine and fine granular structure; soft, very friable, slightly sticky, nonplastic; common very fine roots; 15 percent cobbles; 45 percent gravel; disseminated lime; common distinct lime casts on undersides of rock fragments; violently effervescent; moderately alkaline; clear smooth boundary.
- 2C—21 to 60 inches; light gray (2.5Y 7/2) extremely cobbly coarse sand, light yellowish brown (2.5Y 6/3) moist; single grain; loose, nonsticky, nonplastic; 25 percent cobbles; 40 percent gravel; disseminated lime; common distinct lime casts on undersides of rock fragments; strongly effervescent; moderately alkaline.

Range in Characteristics

Mean annual soil temperature: 38 to 42 degrees F

Moisture control section: Between 4 and 12 inches; dry in all parts between four-tenths and five-tenths of the cumulative days per year when the soil temperature at a depth of 20 inches is 41 degrees F or higher

Depth to the argillic horizon: 5 to 8 inches

Depth to the Bk horizon: 10 to 15 inches

Depth to the 2C horizon: 20 to 40 inches

Surface stones and boulders: 0 to 3 percent

A horizon

Hue: 10YR or 2.5Y

Value: 4 or 5 dry; 2 or 3 moist

Chroma: 2 or 3

Clay content: 18 to 27 percent

Content of rock fragments: 15 to 50 percent—5 to 20 percent cobbles; 10 to 30 percent gravel
Reaction: pH 6.6 to 7.3

Bt horizon

Hue: 10YR or 2.5Y
Value: 4 or 5 dry; 3 or 4 moist
Chroma: 3 or 4
Texture: Sandy clay loam, loam, or clay loam
Clay content: 25 to 35 percent
Content of rock fragments: 35 to 60 percent—10 to 20 percent cobbles; 25 to 40 percent gravel
Reaction: pH 6.6 to 7.8

Bk horizon

Hue: 10YR or 2.5Y
Value: 6 to 8 dry; 5 to 7 moist
Chroma: 2 to 4
Texture: Sandy loam or loam
Clay content: 12 to 20 percent
Content of rock fragments: 45 to 75 percent—15 to 25 percent cobbles; 30 to 50 percent gravel
Calcium carbonate equivalent: 3 to 15 percent
Reaction: pH 7.9 to 8.4

2C horizon

Hue: 10YR or 2.5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Coarse sand or loamy sand
Clay content: 0 to 10 percent
Content of rock fragments: 50 to 80 percent—20 to 30 percent cobbles; 30 to 50 percent gravel
Calcium carbonate equivalent: 0 to 5 percent
Reaction: pH 7.4 to 8.4

Spudbar Series

Depth class: Moderately deep

Drainage class: Well drained

Permeability: Moderate

Landform: Strike ridges, hills, escarpments, and ridges in foothills

Parent material: Colluvium over residuum from igneous rock

Slope range: 2 to 60 percent

Elevation range: 5,000 to 6,500 feet

Annual precipitation: 10 to 14 inches

Annual air temperature: 39 to 45 degrees F

Frost-free period: 70 to 105 days

Taxonomic Class: Loamy-skeletal, mixed, superactive, frigid Aridic Calciustolls

Typical Pedon

Spudbar very cobbly loam, in an area of Rencot-Spudbar-Rock outcrop complex, 8 to 25 percent slopes, in an area of rangeland, 1,700 feet north and 50 feet west of

the southeast corner of sec. 5, T. 6 S., R. 9 W. Bond topographic quadrangle (lat. 45°20'21"N; long. 112°43'27"W)

- A—0 to 6 inches; brown (10YR 5/3) very cobbly loam, dark brown (10YR 3/3) moist; weak fine subangular blocky structure parting to weak fine granular; soft, very friable, slightly sticky, slightly plastic; few medium, common fine, and many very fine roots; many very fine interstitial pores; 20 percent cobbles; 20 percent gravel; disseminated lime; slightly effervescent; slightly alkaline; clear smooth boundary.
- Bk1—6 to 18 inches; very pale brown (10YR 8/3) very gravelly loam, pale brown (10YR 6/3) moist; weak fine subangular blocky structure parting to weak fine granular; soft, very friable, slightly sticky, slightly plastic; few fine and common very fine roots; common fine interstitial pores; 15 percent cobbles; 40 percent gravel; many distinct carbonate coats on rock fragments; common fine irregular masses of lime; violently effervescent; moderately alkaline; clear smooth boundary.
- Bk2—18 to 22 inches; very pale brown (10YR 8/2) extremely gravelly sandy loam, pale brown (10YR 6/3) moist; weak fine granular structure; soft, very friable, slightly sticky, nonplastic; few very fine roots; few very fine interstitial pores; 15 percent cobbles; 60 percent gravel; many distinct carbonate coats on rock fragments; common fine irregular masses of lime; violently effervescent; moderately alkaline.
- R—22 to 60 inches; slightly weathered igneous rock.

Range in Characteristics

Mean annual soil temperature: 38 to 43 degrees F; frigid soil temperature regime

Moisture control section: Between 4 and 12 inches; ustic moisture regime: dry in all parts between four-tenths and five-tenths of the cumulative days per year when the soil temperature at a depth of 20 inches is 41 degrees F or higher

Depth to the lithic contact: 20 to 40 inches

Depth to the Bk horizon: 5 to 8 inches

Thickness of the mollic epipedon: 7 to 8 inches

A horizon

Hue: 10YR or 2.5Y

Value: 4 or 5 dry; 2 or 3 moist

Chroma: 2 or 3

Texture: Loam, sandy loam, or silt loam

Clay content: 10 to 25 percent

Content of rock fragments: 20 to 60 percent—0 to 25 percent cobbles; 20 to 35 percent gravel

Calcium carbonate equivalent: 5 to 15 percent

Reaction: pH 7.4 to 8.4

Bk1 horizon

Hue: 10YR or 2.5Y

Value: 5 to 8 dry; 4 to 6 moist

Chroma: 2 to 4

Texture: Loam, sandy loam, or silt loam

Clay content: 10 to 25 percent

Content of rock fragments: 25 to 60 percent—0 to 15 percent cobbles; 25 to 45 percent gravel

Calcium carbonate equivalent: 10 to 30 percent

Reaction: pH 7.6 to 8.6

Bk2 horizon

Hue: 7.5YR, 10YR, or 2.5Y

Value: 5 to 8 dry; 4 to 6 moist

Chroma: 2 to 4

Texture: Sandy loam, loam, or silt loam

Clay content: 10 to 25 percent

Content of rock fragments: 35 to 80 percent—0 to 15 percent cobbles; 35 to 65 percent gravel

Calcium carbonate equivalent: 15 to 30 percent

Reaction: pH 7.6 to 8.6

Surdal Series*Depth class:* Moderately deep*Drainage class:* Well drained*Permeability:* Moderate*Landform:* Strike ridges, ridges, and mountains*Parent material:* Local colluvium, slope alluvium, and residuum from hard, fine-grained igneous or metamorphic rock*Slope range:* 2 to 60 percent*Elevation range:* 5,500 to 7,800 feet*Annual precipitation:* 15 to 24 inches*Annual air temperature:* 36 to 40 degrees F*Frost-free period:* 30 to 70 days**Taxonomic Class:** Loamy-skeletal, mixed, superactive Ustic Haplocryolls**Typical Pedon**

Surdal cobbly loam, in an area of Surdal, stony-Arrowpeak, very stony complex, 4 to 25 percent slopes, in an area of rangeland, 650 feet south and 400 feet west of the northeast corner of sec. 1, T. 3 N., R. 4 W. Jefferson County, Montana.

A1—0 to 7 inches; dark grayish brown (10YR 4/2) cobbly loam, very dark brown (10YR 2/2) moist; moderate fine and medium granular structure; slightly hard, very friable, slightly sticky, nonplastic; many very fine and fine roots; 10 percent cobbles; 10 percent gravel; slightly acid; clear wavy boundary.

A2—7 to 13 inches; dark grayish brown (10YR 4/2) very cobbly loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; slightly hard, very friable, slightly sticky, nonplastic; many very fine and fine roots; many very fine and fine pores; 15 percent cobbles; 25 percent gravel; slightly acid; clear wavy boundary.

Bw1—13 to 23 inches; grayish brown (10YR 5/2) very cobbly loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; slightly hard, very friable, slightly sticky, nonplastic; many very fine and fine roots; many very fine and fine pores; 15 percent cobbles; 30 percent gravel; slightly acid; gradual wavy boundary.

Bw2—23 to 31 inches; brown (10YR 5/3) very cobbly loam, brown (10YR 4/3) moist; weak coarse subangular blocky structure; slightly hard, very friable, nonsticky, nonplastic; few medium and common very fine and fine roots; common very fine and fine pores; 30 percent cobbles; 30 percent gravel; slightly acid.

R—31 inches; slightly fractured, hard, fine-grained igneous bedrock.

Range in Characteristics

Mean annual soil temperature: 36 to 42 degrees F

Moisture control section: Between 4 and 12 inches

Thickness of the mollic epipedon: 7 to 14 inches

Depth to the lithic contact: 20 to 40 inches

Surface stones and boulders: 0.01 to 3 percent

A horizons

Hue: 10YR or 2.5Y

Value: 3 or 4 dry; 2 or 3 moist

Clay content: 18 to 27 percent

Content of rock fragments: 15 to 50 percent—0 to 15 percent boulders, stones, and cobbles; 10 to 30 percent gravel

Reaction: pH 6.1 to 6.5

Bw1 horizon

Hue: 10YR or 2.5Y

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 or 3

Texture: Loam or sandy clay loam

Clay content: 18 to 27 percent

Content of rock fragments: 35 to 60 percent—10 to 20 percent cobbles; 25 to 40 percent gravel

Reaction: pH 6.1 to 6.5

Bw2 horizon

Hue: 7.5YR, 10YR, or 2.5Y

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 or 3

Texture: Loam, sandy clay loam, or sandy loam

Clay content: 18 to 27 percent

Content of rock fragments: 35 to 80 percent—5 to 30 percent cobbles; 30 to 50 percent gravel

Reaction: pH 6.1 to 6.5

Thess Series

Depth class: Very deep

Drainage class: Well drained

Permeability: Moderate to 30 inches and very rapid below

Landform: Stream terraces, alluvial fans, and hills

Parent material: Alluvium

Slope range: 0 to 8 percent

Elevation range: 4,800 to 6,500 feet

Annual precipitation: 10 to 14 inches

Annual air temperature: 38 to 42 degrees F

Frost-free period: 70 to 105 days

Taxonomic Class: Fine-loamy over sandy or sandy-skeletal, mixed, superactive, frigid Aridic Calcustepts

Typical Pedon

Thess loam, 0 to 4 percent slopes, in an area of rangeland, 2,100 feet west and 400 feet south of the northeast corner of sec. 9, T. 9 S., R. 8 W. Ashbough Canyon topographic quadrangle (lat. 45°04'16"N; long. 112°35'14"W)

- A—0 to 3 inches; grayish brown (2.5Y 5/2) loam, dark grayish brown (2.5Y 4/2) moist; weak very fine, fine, and medium granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine and fine roots; disseminated lime; violently effervescent; moderately alkaline; clear smooth boundary.
- Bk1—3 to 21 inches; light brownish gray (2.5Y 6/2) loam, grayish brown (2.5Y 5/2) moist; moderate medium and coarse subangular blocky structure; very hard, firm, moderately sticky, moderately plastic; many very fine and fine roots; disseminated lime; violently effervescent; moderately alkaline; clear wavy boundary.
- Bk2—21 to 30 inches; light yellowish brown (2.5Y 6/3) loam, light olive brown (2.5Y 5/3) moist; weak coarse subangular blocky structure; very hard, very friable, moderately sticky, moderately plastic; many very fine and fine roots; many coarse masses of lime; violently effervescent; moderately alkaline; clear smooth boundary.
- 2Bk3—30 to 60 inches; extremely gravelly loamy sand; variegated; single grain; loose, nonsticky, nonplastic; 10 percent cobbles; 60 percent gravel; disseminated lime; continuous distinct carbonate coats on surface of rock fragments; strongly effervescent; moderately alkaline.

Range in Characteristics

Mean annual soil temperature: 40 to 45 degrees F

Moisture control section: Between 4 and 12 inches; dry in all parts between four-tenths and five-tenths of the cumulative days per year when the soil temperature at a depth of 20 inches is 41 degrees F or higher

Depth to the calcic horizon: 3 to 5 inches

Depth to the 2Bk horizon: 20 to 35 inches

A horizon

Hue: 10YR or 2.5Y

Value: 5 or 6 dry; 3 to 5 moist

Chroma: 2 or 3

Clay content: 15 to 24 percent

Content of rock fragments: 0 to 15 percent—0 to 5 percent stones or cobbles; 0 to 10 percent gravel

Reaction: pH 7.4 to 8.4

Bk1 horizon

Hue: 10YR or 2.5Y

Value: 6 or 7 dry; 5 or 6 moist

Chroma: 2 or 3

Texture: Loam or sandy loam

Clay content: 15 to 24 percent

Content of rock fragments: 0 to 15 percent—0 to 5 percent cobbles; 0 to 10 percent gravel

Calcium carbonate equivalent: 15 to 40 percent

Reaction: pH 7.4 to 8.4

Bk2 horizon

Hue: 10YR or 2.5Y

Value: 6 to 8 dry; 5 to 7 moist

Chroma: 2 or 3

Texture: Thin strata of loam or sandy loam

Clay content: 15 to 24 percent

Content of rock fragments: 0 to 15 percent—0 to 5 percent cobbles; 0 to 10 percent gravel

Calcium carbonate equivalent: 15 to 40 percent

Reaction: pH 7.4 to 8.4

2Bk3 horizon

Hue: 10YR or 2.5Y (variegated)

Value: 6 to 8 dry; 5 to 7 moist

Chroma: 2 or 3

Texture: Loamy sand or sand

Clay content: 0 to 5 percent

Content of rock fragments: 35 to 85 percent—0 to 25 percent cobbles; 35 to 60 percent gravel

Calcium carbonate equivalent: 15 to 25 percent

Reaction: pH 7.4 to 8.4

Thessvo Series

Depth class: Very deep

Drainage class: Well drained

Permeability: Moderate in the upper 15 inches and very rapid below

Landform: Alluvial fans, fan terraces, and stream terraces in valleys

Parent material: Calcareous alluvium

Slope range: 0 to 4 percent

Elevation range: 4,800 to 6,400

Annual precipitation: 10 to 14 inches

Annual air temperature: 37 to 45 degrees F

Frost-free period: 70 to 105 days

Taxonomic Class: Fine-loamy over sandy or sandy-skeletal, mixed, frigid Aridic Haplustepts

Typical Pedon

Thessvo loam, in an area of Thessvo-Scravo complex, 0 to 4 percent slopes, in an area of cropland, 400 feet north and 350 feet east of the southwest corner of sec. 1, T. 8 S., R. 9 W. Dillon West topographic quadrangle (lat. 45°09'40"N; long. 112°39'40"W)

Ap—0 to 4 inches; grayish brown (10YR 5/2) loam, brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure parting to weak fine granular; soft, very friable, moderately sticky, slightly plastic; few fine and many very fine roots; common fine and many very fine interstitial pores; 10 percent gravel; disseminated lime; strongly effervescent; slightly alkaline; clear smooth boundary.

Bk1—4 to 11 inches; brown (10YR 5/3) loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; slightly hard, friable, moderately sticky, slightly plastic; few fine and many very fine roots; few fine and many very fine tubular and interstitial pores; 10 percent gravel; many fine masses of lime; disseminated lime; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk2—11 to 15 inches; very pale brown (10YR 7/3) gravelly loam, pale brown (10YR 6/3) moist; weak medium prismatic structure parting to moderate fine and medium subangular blocky; slightly hard, friable, slightly sticky, slightly plastic; common fine roots; many very fine tubular and interstitial pores; 20 percent gravel; many fine masses of lime; disseminated lime; common prominent lime coats and casts on undersides of rock fragments; violently effervescent; moderately alkaline; abrupt smooth boundary.

2C—15 to 60 inches; pale brown (10YR 6/3) extremely gravelly sand, brown (10YR 5/3) moist; single grain; loose; common very fine roots; 15 percent cobbles; 50 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Mean annual soil temperature: 40 to 47 degrees F; frigid temperature regime

Moisture control section: Between 4 and 12 inches; ustic moisture regime: dry in all parts between four-tenths and five-tenths of the cumulative days per year when the soil temperature at a depth of 20 inches is 41 degrees F or higher

Depth to the Bk horizon: 3 to 6 inches

Depth to the 2C horizon: 11 to 20 inches

Ap horizon

Hue: 10YR or 2.5Y

Value: 5 or 6 dry; 3 or 4 moist

Chroma: 2 or 3

Texture: Loam, sandy loam, or sandy clay loam

Clay content: 15 to 25 percent

Content of rock fragments: 0 to 30 percent—0 to 5 percent cobbles; 0 to 25 percent gravel

Calcium carbonate equivalent: 0 to 15 percent

Reaction: pH 6.6 to 7.8

Bk1 horizon

Hue: 10YR or 2.5Y

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 or 3

Texture: Loam, sandy loam, or sandy clay loam

Clay content: 18 to 25 percent

Content of rock fragments: 0 to 35 percent gravel

Calcium carbonate equivalent: 5 to 15 percent

Reaction: pH 7.4 to 8.4

Bk2 horizon

Hue: 10YR or 2.5Y

Value: 6 or 7 dry; 5 or 6 moist

Chroma: 2 or 3

Texture: Loam, sandy loam, or sandy clay loam

Clay content: 18 to 25 percent

Content of rock fragments: 0 to 35 percent gravel

Calcium carbonate equivalent: 15 to 30 percent

Reaction: pH 7.9 to 8.4

2C horizon

Hue: 10YR or 2.5Y

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 to 4

Texture: Sand, loamy sand, loamy coarse sand, or coarse sand

Clay content: 0 to 10 percent

Content of rock fragments: 35 to 85 percent—0 to 20 percent cobbles; 35 to 65 percent gravel

Calcium carbonate equivalent: 0 to 15 percent

Reaction: pH 7.4 to 8.4

Threeriv Series

Depth class: Very deep

Drainage class: Very poorly drained

Permeability: Moderately slow

Landform: Flood plains

Parent material: Alluvium

Slope range: 0 to 2 percent

Elevation range: 4,800 to 6,500 feet

Annual precipitation: 10 to 14 inches

Annual air temperature: 38 to 42 degrees F

Frost-free period: 70 to 105 days

Taxonomic Class: Fine-loamy over sandy or sandy-skeletal, mixed, superactive, calcareous, frigid Typic Fluvaquents

Typical Pedon

Threeriv silt loam, in an area of Beavrock-Threeriv silt loams, 0 to 4 percent slopes, in an area of rangeland, 1,000 feet east and 2,000 feet north of the southwest corner of sec. 18, T. 7 S., R. 8 W. Dillon West topographic quadrangle (lat. 45°13'30"N; long. 112°38'25"W)

Oe—0 to 2 inches; moderately decomposed vegetation, slightly alkaline; clear smooth boundary.

Ag—2 to 9 inches; gray (10YR 5/1) silt loam, dark gray (10YR 4/1) moist; few fine distinct light brown (7.5YR 6/4) redox concentrations; weak medium subangular blocky structure; very hard, firm, moderately sticky, moderately plastic; many very fine and fine roots; strongly effervescent; moderately alkaline; clear smooth boundary.

Cg—9 to 24 inches; gray (10YR 6/1) sandy clay loam consisting of strata of sandy clay loam, loam, and sandy loam, gray (10YR 5/1) moist; many medium prominent (7.5YR 6/4) redox concentrations; massive; hard, firm, slightly sticky, slightly plastic; common very fine, fine, and medium roots; strongly effervescent; moderately alkaline; clear smooth boundary.

2C—24 to 60 inches; variegated extremely gravelly sand; single grain; loose, nonsticky, nonplastic; 10 percent cobbles; 60 percent gravel; slightly effervescent; slightly alkaline.

Range in Characteristics

Mean annual soil temperature: 38 to 42 degrees F

Moisture control section: Between 4 and 12 inches

Depth to the 2C horizon: 20 to 40 inches

Depth to the seasonal high water table: 0 to 12 inches

Ag horizon

Hue: 10YR or N

Value: 5 or 6 dry; 3 or 4 moist

Clay content: 18 to 27 percent

Content of rock fragments: 0 to 10 percent gravel

Calcium carbonate equivalent: 2 to 15 percent

Reaction: pH 7.9 to 8.4

Cg horizon

Hue: 10YR, 2.5Y, or 5Y

Value: 5 to 7 dry; 4 to 6 moist

Chroma: 1 or 2

Texture: Stratified sandy clay loam, sandy loam, clay loam, or loam
 Clay content: 18 to 35 percent
 Content of rock fragments: 0 to 10 percent gravel
 Calcium carbonate equivalent: 2 to 15 percent
 Reaction: pH 7.9 to 8.4

2C horizon

Texture: Loamy sand, sand, or coarse sand
 Clay content: 0 to 5 percent
 Content of rock fragments: 35 to 80 percent—10 to 20 percent cobbles; 25 to 60 percent gravel
 Reaction: pH 7.4 to 8.4

Thunderhead Series

Depth class: Moderately deep
Drainage class: Well drained
Permeability: Moderate
Landform: Strike ridges and hills in foothills
Parent material: Hard sedimentary rock
Slope range: 8 to 15 percent
Elevation range: 5,000 to 6,500 feet
Annual precipitation: 10 to 14 inches
Annual air temperature: 39 to 45 degrees F
Frost-free period: 70 to 90 days

Taxonomic Class: Fine-loamy, mixed, superactive, frigid Calcic Argiustolls

Typical Pedon

Thunderhead gravelly loam, in an area of Twinadams-Thunderhead-Blackleaf, stony complex, 8 to 25 percent slopes, in an area of rangeland, 1,300 feet north and 1,200 feet east of the southwest corner of sec. 18, T. 3 S., R. 9 W. Storm Peak topographic quadrangle (lat. 45°34'21"N; long. 112°46'15"W)

- A—0 to 5 inches; light olive brown (2.5Y 5/3) gravelly loam, dark olive brown (2.5Y 3/3) moist; weak fine and medium subangular blocky structure parting to weak fine granular; soft, very friable, slightly sticky, slightly plastic; few fine and many very fine roots; 15 percent gravel; neutral; clear smooth boundary.
- Bt—5 to 13 inches; light olive brown (2.5Y 5/3) clay loam, olive brown (2.5Y 4/3) moist; weak medium prismatic structure parting to weak fine granular; slightly hard, friable, moderately sticky, slightly plastic; few fine and many very fine roots; many distinct clay films on faces of peds and surfaces of rock fragments; 10 percent gravel; neutral; clear wavy boundary.
- Bk1—13 to 22 inches; light gray (2.5Y 7/2) gravelly loam, light yellowish brown (2.5Y 6/3) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, moderately sticky, slightly plastic; few fine and common very fine roots; 5 percent cobbles; 20 percent gravel; violently effervescent; disseminated lime; common masses of lime; moderately alkaline; clear wavy boundary.
- Bk2—22 to 28 inches; pale yellow (2.5Y 7/3) very gravelly silty clay loam, light yellowish brown (2.5Y 6/3) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, moderately sticky, slightly plastic; few fine roots; 15 percent cobbles; 30 percent gravel; disseminated lime; common masses of lime; violently effervescent; moderately alkaline; clear smooth boundary.

Cr—28 to 40 inches; light olive gray (5Y 6/2) semiconsolidated sedimentary beds that crush to silt loam, olive gray (5Y 4/1) moist; strongly effervescent; slightly alkaline.

R—40 inches; hard sedimentary rock.

Range in Characteristics

Mean annual soil temperature: 38 to 44 degrees F

Moisture control section: Between 4 and 12 inches; ustic moisture regime: dry in all parts between four-tenths and five-tenths of the cumulative days per year when the soil temperature at a depth of 20 inches is 41 degrees F or higher

Depth to the argillic horizon: 5 to 7 inches

Depth to the calcic horizon: 11 to 22 inches

Depth to the Cr horizon: 22 to 40 inches

Depth to the lithic contact: 25 to 40 inches

A horizon

Hue: 7.5YR, 10YR, or 2.5Y

Value: 4 or 5 dry; 2 or 3 moist

Chroma: 2 or 3

Texture: Sandy loam or loam

Clay content: 15 to 25 percent

Content of rock fragments: 0 to 35 percent—0 to 10 percent cobbles; 0 to 25 percent gravel

Reaction: pH 6.6 to 7.6

Bt horizon

Hue: 7.5YR, 10YR, or 2.5Y

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 3, 4, or 6

Texture: Sandy clay loam, loam, or clay loam

Clay content: 22 to 35 percent

Content of rock fragments: 0 to 35 percent—0 to 10 percent cobbles; 0 to 25 percent gravel

Reaction: pH 6.6 to 7.6

Bk1 horizon

Hue: 7.5YR, 10YR, 2.5Y, or 5Y

Value: 6 or 7 dry; 5 or 6 moist

Chroma: 2 or 3

Texture: Sandy loam, sandy clay loam, loam, or clay loam

Clay content: 15 to 30 percent

Content of rock fragments: 10 to 35 percent—0 to 10 percent cobbles; 10 to 25 percent gravel

Calcium carbonate equivalent: 5 to 15 percent

Reaction: pH 7.6 to 8.6

Bk2 horizon

Hue: 7.5YR, 10YR, 2.5Y, or 5Y

Value: 6 or 7 dry; 5 or 6 moist

Chroma: 2 to 4

Texture: Silty clay loam, sandy loam, or loam

Clay content: 15 to 30 percent

Content of rock fragments: 20 to 60 percent—0 to 15 percent cobbles; 20 to 45 percent gravel

Calcium carbonate equivalent: 15 to 30 percent

Reaction: pH 7.6 to 8.6

Tiban Series

Depth class: Very deep

Drainage class: Well drained

Permeability: Moderate

Landform: Hills, alluvial fans, moraines, escarpments, and mountain slopes

Parent material: Alluvium or glacial till from mixed rock sources

Slope range: 1 to 60 percent

Elevation range: 5,000 to 8,000

Annual precipitation: 15 to 19 inches

Annual air temperature: 34 to 38 degrees F

Frost-free period: 30 to 70 days

Taxonomic Class: Loamy-skeletal, mixed, superactive Ustic Haplocryolls

Typical Pedon

Tiban very cobbly loam, in an area of Tiban-Philipsburg-Roxal complex, 15 to 45 percent slopes, in an area of rangeland, 1,800 feet east and 1,300 feet south of the northwest corner of sec. 3, T. 10 S., R. 5 W. Swamp Creek topographic quadrangle (lat. 44°59'50"N; long. 112°12'16"W)

- A—0 to 6 inches; dark grayish brown (10YR 4/2) very cobbly loam, very dark grayish brown (10YR 3/2) moist; weak very fine and fine granular structure; slightly hard, very friable, nonsticky, nonplastic; many very fine, fine, and medium roots; 15 percent cobbles; 30 percent gravel; neutral; clear smooth boundary.
- Bw1—6 to 12 inches; brown (10YR 5/3) very gravelly sandy clay loam, dark brown (10YR 3/3) moist; weak medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky, nonplastic; many very fine, fine, and medium roots; 10 percent cobbles; 40 percent gravel; neutral; clear wavy boundary.
- Bw2—12 to 20 inches; pale brown (10YR 6/3) very gravelly sandy clay loam, brown (10YR 4/3) moist; weak medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; common very fine and fine roots; 5 percent cobbles; 55 percent gravel; slightly alkaline; clear wavy boundary.
- Bk—20 to 60 inches; very pale brown (10YR 7/3) extremely gravelly loam, pale brown (10YR 6/3) moist; weak coarse subangular blocky structure; soft, very friable, slightly sticky, slightly plastic; few very fine roots; 5 percent cobbles; 60 percent gravel; common distinct carbonate coats on undersides of rock fragments; common fine masses of lime; violently effervescent; moderately alkaline.

Range in Characteristics

Mean annual soil temperature: 36 to 38 degrees F

Moisture control section: Between 4 and 12 inches

Thickness of the mollic epipedon: 7 to 15 inches

Depth to the Bk horizon: 15 to 32 inches

A horizon

Value: 3 to 5 dry; 2 or 3 moist

Chroma: 2 or 3

Clay content: 18 to 27 percent

Content of rock fragments: 15 to 60 percent—0 to 25 percent cobbles; 15 to 35 percent gravel

Reaction: pH 6.1 to 7.3

Bw horizons

Value: 4 to 6 dry; 3 to 5 moist

Chroma: 2 to 4

Texture: Loam or sandy clay loam

Clay content: 18 to 27 percent

Content of rock fragments: 15 to 60 percent—0 to 20 percent cobbles; 15 to 55 percent gravel

Calcium carbonate equivalent: 0 to 5 percent

Reaction: pH 6.6 to 7.9

Bk horizon

Hue: 10YR or 2.5Y

Value: 4 to 7 dry; 3 to 6 moist

Chroma: 2 to 4

Texture: Loam or sandy loam

Clay content: 15 to 27 percent

Content of rock fragments: 35 to 80 percent—0 to 20 percent cobbles; 35 to 60 percent gravel

Calcium carbonate equivalent: 5 to 15 percent

Reaction: pH 7.9 to 8.4

Tibkey Series

Depth class: Very deep

Drainage class: Somewhat poorly drained

Permeability: Moderate

Landform: Flood plains and drainageways

Parent material: Slope alluvium or alpine glacial till from fine-grained igneous and metamorphic rocks

Slope range: 2 to 15 percent

Elevation range: 5,500 to 7,500 feet

Annual precipitation: 15 to 24 inches

Annual air temperature: 36 to 40 degrees F

Frost-free period: 30 to 70 days

Taxonomic Class: Loamy-skeletal, mixed, superactive Fluvaquent Haplocryolls

Typical Pedon

Tibkey mucky-silt loam, in an area of Marcel, very bouldery-Tibkey, bouldery complex, 2 to 8 percent slopes, in an area of rangeland, 1,700 feet north and 350 feet east of the southwest corner of sec. 1, T. 4 N., R. 4 W. Jefferson County, Montana.

A1—0 to 2 inches; very dark grayish brown (10YR 3/2) mucky-silt loam, very dark brown (10YR 2/2) moist; massive; slightly hard, very friable, nonsticky, nonplastic; many very fine and fine roots; 10 percent gravel; slightly acid; clear wavy boundary.

A2—2 to 8 inches; very dark gray (10YR 3/1) mucky-silt loam, black (10YR 2/1) moist; strong medium prismatic structure parting to moderate fine and medium subangular blocky; hard, firm, slightly sticky, slightly plastic; many very fine and fine roots; many very fine and fine pores; 10 percent gravel; neutral; clear wavy boundary.

Bw1—8 to 13 inches; grayish brown (10YR 5/2) very gravelly loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; slightly hard, firm, slightly sticky, slightly plastic;

many very fine and fine roots; many very fine and fine pores; 40 percent gravel; neutral; clear wavy boundary.

Bw2—13 to 25 inches; light brownish gray (10YR 6/2) very gravelly loam, brown (10YR 5/3) moist; moderate medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine and fine roots; many very fine and fine pores; 5 percent cobbles; 30 percent gravel; neutral; gradual wavy boundary.

Bw3—25 to 32 inches; light gray (10YR 7/2) very gravelly loam, brown (10YR 5/3) moist; few fine distinct yellowish brown (10YR 5/6) redox concentrations; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine and fine roots; many very fine and fine pores; 5 percent cobbles; 30 percent gravel; neutral; gradual irregular boundary.

BC—32 to 60 inches; very pale brown (10YR 7/3) very gravelly loam, pale brown (10YR 6/3) moist; common fine prominent strong brown (7.5YR 5/6) redox concentrations; massive; slightly hard, very friable, slightly sticky, nonplastic; common very fine and fine roots; common very fine and fine pores; 5 percent cobbles; 40 percent gravel; slightly alkaline.

Range in Characteristics

Mean annual soil temperature: 38 to 42 degrees F

Moisture control section: Between 4 and 12 inches

Thickness of the mollic epipedon: 8 to 15 inches

Depth to the seasonal high water table: 24 to 42 inches from May through July

Surface boulders: 0 to 0.1 percent

A horizons

Hue: 10YR or 2.5Y

Value: 2 to 4 dry; 2 or 3 moist

Chroma: 1 or 2

Texture: Loam, mucky-silt loam, or mucky-loam

Clay content: 15 to 27 percent

Content of rock fragments: 10 to 40 percent—0 to 15 percent boulders, stones, and cobbles; 10 to 35 percent gravel

Reaction: pH 6.1 to 7.3

Bw1 and Bw2 horizons

Hue: 10YR or 2.5Y

Value: 4 to 6 dry; 3 to 5 moist

Chroma: 2 or 3

Texture: Silt loam, clay loam, sandy clay loam, or loam

Clay content: 18 to 30 percent

Content of rock fragments: 15 to 50 percent—0 to 15 percent boulders, stones, and cobbles; 15 to 40 percent gravel

Reaction: pH 6.6 to 7.3

Bw3 horizon

Value: 5 to 7 dry; 4 to 6 moist

Chroma: 2 or 3

Texture: Loam, clay loam, or sandy clay loam

Clay content: 18 to 30 percent

Content of rock fragments: 35 to 60 percent—0 to 10 percent stones or cobbles; 30 to 50 percent gravel

Reaction: pH 6.6 to 7.3

BC horizon

Value: 6 or 7 dry; 5 or 6 moist

Chroma: 2 to 4

Texture: Loam or sandy clay loam

Clay content: 18 to 27 percent

Content of rock fragments: 35 to 60 percent—0 to 10 percent cobbles; 35 to 50 percent gravel

Reaction: pH 6.6 to 7.8

Trimad Series

Depth class: Very deep

Drainage class: Well drained

Permeability: Moderate to 26 inches and moderately rapid below

Landform: Alluvial fans, hills, escarpments, and terraces

Parent material: Alluvium from mixed rock sources

Slope range: 2 to 45 percent

Elevation range: 4,500 to 6,800 feet

Annual precipitation: 10 to 14 inches

Annual air temperature: 38 to 42 degrees F

Frost-free period: 70 to 105 days

Taxonomic Class: Loamy-skeletal, mixed, superactive, frigid Aridic Calciustolls

Typical Pedon

Trimad gravelly loam, 2 to 8 percent slopes, in an area of rangeland, 300 feet east and 1,000 feet south of the northwest corner of sec. 22, T. 10 S., R. 6 W. Price Creek NE topographic quadrangle (lat. 44°57'15"N; long. 112°19'59"W)

A—0 to 3 inches; grayish brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure parting to very fine and fine granular; soft, very friable, slightly sticky, slightly plastic; many very fine and fine roots; 20 percent gravel; slightly alkaline; abrupt smooth boundary.

Bw—3 to 7 inches; brown (10YR 5/3) gravelly loam, dark brown (10YR 3/3) moist; weak medium and coarse prismatic structure; slightly hard, friable, moderately sticky, moderately plastic; many very fine and fine roots; 15 percent gravel; disseminated lime; slightly effervescent; slightly alkaline; clear smooth boundary.

Bk1—7 to 12 inches; light gray (10YR 7/2) gravelly loam, brown (10YR 5/3) moist; weak medium subangular blocky structure; hard, friable, moderately sticky, moderately plastic; many fine roots; 25 percent gravel; common distinct carbonate coats on rock fragments; many fine masses of lime; violently effervescent; moderately alkaline; clear wavy boundary.

Bk2—12 to 26 inches; very pale brown (10YR 7/3) very gravelly loam, pale brown (10YR 6/3) moist; weak coarse subangular blocky structure; hard, friable, moderately sticky, moderately plastic; few fine roots; 5 percent cobbles; 45 percent gravel; common distinct carbonate coats surrounding rock fragments; many coarse masses of lime; violently effervescent; moderately alkaline; gradual wavy boundary.

Bk3—26 to 60 inches; light gray (10YR 7/2) extremely gravelly sandy loam, light brownish gray (10YR 6/2) moist; massive; soft, very friable, slightly sticky, nonplastic; 10 percent cobbles; 60 percent gravel; common distinct carbonate coats surrounding rock fragments; disseminated lime; violently effervescent; moderately alkaline.

Range in Characteristics

Mean annual soil temperature: 40 to 42 degrees F

Moisture control section: Between 4 and 12 inches; dry in all parts between four-tenths and five-tenths of the cumulative days per year when the soil temperature at a depth of 20 inches is 41 degrees F or higher

Thickness of the mollic epipedon: 7 to 10 inches

Depth to the Bk horizon: 5 to 10 inches

A horizon

Hue: 10YR or 2.5Y

Value: 4 or 5 dry

Chroma: 2 or 3

Clay content: 15 to 27 percent

Content of rock fragments: 5 to 50 percent—0 to 20 percent cobbles; 5 to 30 percent gravel

Reaction: pH 6.6 to 7.9

Bw horizon

Hue: 10YR or 2.5Y

Value: 4 or 5 dry

Chroma: 2 or 3

Clay content: 15 to 27 percent

Content of rock fragments: 15 to 50 percent—0 to 20 percent cobbles; 5 to 30 percent gravel

Calcium carbonate equivalent: 0 to 5 percent

Reaction: pH 6.6 to 7.9

Bk1 horizon

Hue: 10YR or 2.5Y

Value: 5 to 7 dry; 4 to 6 moist

Chroma: 2 to 4

Texture: Loam or sandy loam

Clay content: 15 to 25 percent

Content of rock fragments: 15 to 50 percent—0 to 20 percent cobbles; 5 to 30 percent gravel

Calcium carbonate equivalent: 10 to 15 percent

Reaction: pH 7.9 to 8.4

Bk2 horizon

Hue: 10YR or 2.5Y

Value: 5 to 7 dry; 5 or 6 moist

Chroma: 2 to 4

Texture: Loam or sandy loam

Clay content: 10 to 15 percent

Content of rock fragments: 35 to 70 percent—5 to 25 percent cobbles; 25 to 45 percent gravel

Calcium carbonate equivalent: 15 to 25 percent

Reaction: pH 7.9 to 8.4

Bk3 horizon

Hue: 10YR or 2.5Y

Value: 6 to 8 dry; 5 or 6 moist

Chroma: 2 to 4

Texture: Loam or sandy loam

Clay content: 10 to 15 percent

Content of rock fragments: 35 to 70 percent—10 to 20 percent cobbles; 25 to 60 percent gravel
 Calcium carbonate equivalent: 10 to 25 percent
 Reaction: pH 7.9 to 8.4

Trudau Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderately slow
Landform: Alluvial fans, hills, and stream terraces
Parent material: Alluvium derived from calcareous material
Slope range: 0 to 15 percent
Elevation range: 4,800 to 6,500 feet
Annual precipitation: 10 to 14 inches
Annual air temperature: 38 to 42 degrees F
Frost-free period: 70 to 105 days

Taxonomic Class: Fine-loamy, mixed, superactive, frigid Aridic Haplustepts

Typical Pedon

Trudau loam, 2 to 8 percent slopes, in an area of rangeland, 2,600 feet east and 1,900 feet north of the southwest corner of sec. 20, T. 5 S., R. 7 W. Beaverhead Rock topographic quadrangle (lat. 45°23'03"N; long. 112°29'43"W)

- A—0 to 3 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak medium and thick platy structure parting to moderate very thin and thin; hard, friable, slightly sticky, slightly plastic; many very fine, fine, and medium roots; strongly effervescent; strongly alkaline; abrupt smooth boundary.
- Bw—3 to 11 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; strong medium and coarse subangular blocky structure; very hard, friable, moderately sticky, moderately plastic; many fine and medium roots; strongly effervescent; strongly alkaline; clear smooth boundary.
- Bk—11 to 26 inches; very pale brown (10YR 7/3) loam, pale brown (10YR 6/3) moist; weak coarse subangular blocky structure; hard, friable, moderately sticky, moderately plastic; many very fine roots; common fine soft masses of lime; violently effervescent; very strongly alkaline; clear wavy boundary.
- Bkz—26 to 60 inches; pale yellow (10YR 7/3) loam stratified with thin layers of clay loam and sandy loam, light yellowish brown (10YR 6/3) moist; massive; hard, friable, very sticky, moderately plastic; few very fine roots; common fine salt crystals; few fine threads of lime; strongly effervescent; moderately alkaline.

Range in Characteristics

Mean annual soil temperature: 40 to 42 degrees F
Moisture control section: Between 4 and 12 inches; dry in all parts between four-tenths and five-tenths of the cumulative days per year when the soil temperature at a depth of 20 inches is 41 degrees F or higher
Depth to the Bk horizon: 10 to 23 inches
Depth to the Bkz horizon: 20 to 40 inches

A horizon

Hue: 10YR or 2.5Y
 Value: 5 to 7 dry; 3 to 5 moist
 Chroma: 2 or 3
 Clay content: 15 to 27 percent

Content of rock fragments: 0 to 5 percent gravel
Electrical conductivity: 0 to 2 mmhos/cm
Calcium carbonate equivalent: 1 to 10 percent
Reaction: pH 7.9 to 9.0

Bw horizon

Hue: 10YR or 2.5Y
Value: 6 or 7 dry; 4 to 6 moist
Chroma: 2 to 4
Clay content: 18 to 27 percent
Content of rock fragments: 0 to 5 percent gravel
Electrical conductivity: 1 to 16 mmhos/cm
Sodium adsorption ratio: less than 5
Calcium carbonate equivalent: 1 to 10 percent
Reaction: pH 7.4 to 9.0

Bk horizon

Hue: 10YR or 2.5Y
Value: 6 to 8 dry; 5 to 7 moist
Chroma: 2 or 3
Clay content: 18 to 27 percent
Content of rock fragments: 0 to 15 percent gravel
Electrical conductivity: 2 to 16 mmhos/cm
Sodium adsorption ratio: 2 to 13
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.9 to 9.4

Bkz horizon

Hue: 10YR or 2.5Y
Value: 6 to 8 dry; 5 to 7 moist
Chroma: 2 to 4
Texture: Mainly loam stratified with sandy loam, silt loam, or clay loam
Clay content: 18 to 27 percent
Content of rock fragments: 0 to 15 percent—0 to 5 percent cobbles; 0 to 10 percent gravel
Electrical conductivity: 2 to 16 mmhos/cm
Sodium adsorption ratio: 2 to 13
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.9 to 9.4

Twinadams Series

Depth class: Moderately deep
Drainage class: Well drained
Permeability: Moderate
Landform: Strike ridges and hills in foothills
Parent material: Hard sedimentary rock
Slope range: 4 to 60 percent
Elevation range: 5,000 to 6,500 feet
Annual precipitation: 10 to 14 inches
Annual air temperature: 39 to 45 degrees F
Frost-free period: 70 to 90 days

Taxonomic Class: Loamy-skeletal, mixed, superactive, frigid Calcic Haplustalfs

Typical Pedon

Twinadams very channery loam, in an area of Twinadams-Thunderhead-Blackleaf, stony complex, 8 to 25 percent slopes, in an area of rangeland, 300 feet south and 700 feet west of the northeast corner of sec. 31, T. 4 S., R. 9 W. Twin Adams Mountain topographic quadrangle (lat. 45°27'05"N; long. 112°45'35"W)

- A—0 to 4 inches; light olive brown (2.5Y 5/3) very channery loam, dark olive brown (2.5Y 3/3) moist; weak fine and medium subangular blocky structure parting to weak fine granular; soft, very friable, slightly sticky, slightly plastic; few fine and common very fine roots; 15 percent flagstones; 40 percent channers; neutral; clear smooth boundary.
- Bt—4 to 9 inches; light olive brown (2.5Y 5/4) very channery clay loam, olive brown (2.5Y 4/4) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, moderately sticky, moderately plastic; few fine and common very fine roots; many distinct clay films on faces of peds and surfaces of rock fragments; 50 percent channers; neutral; clear smooth boundary.
- Bk1—9 to 17 inches; light gray (2.5Y 7/2) very channery sandy loam, light yellowish brown (2.5Y 6/3) moist; weak fine and medium subangular blocky structure parting to weak fine granular; soft, very friable, slightly sticky, nonplastic; few fine and common very fine roots; 40 percent channers; violently effervescent; common medium masses of lime; moderately alkaline; clear smooth boundary.
- Bk2—17 to 28 inches; light yellowish brown (2.5Y 6/3) very channery sandy loam, light olive brown (2.5Y 5/3) moist; weak fine and medium subangular blocky structure parting to weak fine granular; soft, very friable, slightly sticky, nonplastic; few fine roots; 55 percent channers; disseminated lime; violently effervescent; common medium masses of lime; moderately alkaline; clear smooth boundary.
- Cr—28 to 36 inches; pale yellow (5Y 7/3) semiconsolidated sedimentary beds that crush to sandy loam, olive (5Y 5/4); strongly effervescent; strongly alkaline.
- R—36 inches; hard sedimentary rock.

Range in Characteristics

Mean annual soil temperature: 38 to 44 degrees F

Moisture control section: Between 4 and 12 inches; ustic moisture regime: dry in all parts between four-tenths and five-tenths of the cumulative days per year when the soil temperature at a depth of 20 inches is 41 degrees F or higher

Depth to the argillic horizon: 3 to 6 inches

Depth to the calcic horizon: 7 to 15 inches

Depth to the Cr horizon: 20 to 36 inches

Depth to the lithic contact: 24 to 40 inches

A horizon

Hue: 10YR or 2.5Y

Value: 5 dry; 3 or 4 moist

Chroma: 2 or 3

Texture: Loam, sandy clay loam, sandy loam, or clay loam

Clay content: 15 to 30 percent

Content of rock fragments: 20 to 60 percent—0 to 15 percent flagstones; 20 to 45 percent channers

Reaction: pH 6.1 to 7.6

Bt horizon

Hue: 10YR or 2.5Y

Value: 5 dry; 3 or 4 moist

Chroma: 2 to 4

Texture: Clay loam, sandy clay loam, or loam
 Clay content: 22 to 35 percent
 Content of rock fragments: 35 to 70 percent—0 to 15 percent flagstones; 35 to 55 percent channers
 Reaction: pH 6.1 to 7.8

Bk1 horizon

Hue: 10YR or 2.5Y
 Value: 6 or 7 dry; 5 or 6 moist
 Chroma: 2 or 3
 Texture: Sandy loam, sandy clay loam, or loam
 Clay content: 10 to 30 percent
 Content of rock fragments: 35 to 70 percent—0 to 15 percent flagstones; 35 to 55 percent channers
 Calcium carbonate equivalent: 15 to 30 percent
 Reaction: pH 7.6 to 8.6

Bk2 horizon

Hue: 10YR, 2.5Y, or 5Y
 Value: 6 to 8 dry; 5 or 6 moist
 Chroma: 2 or 3
 Texture: Sandy loam, sandy clay loam, loam, or silt loam
 Clay content: 15 to 25 percent
 Content of rock fragments: 35 to 70 percent—0 to 15 percent flagstones; 35 to 55 percent channers
 Calcium carbonate equivalent: 15 to 30 percent
 Reaction: pH 7.6 to 8.6

Udecide Series

Depth class: Moderately deep
Drainage class: Well drained
Permeability: Moderate
Landform: Alluvial fans, hills, structural benches, and terraces
Parent material: Alluvium over semiconsolidated sandstone
Slope range: 2 to 35 percent
Elevation range: 5,000 to 6,200 feet
Annual precipitation: 10 to 14 inches
Annual air temperature: 38 to 42 degrees F
Frost-free period: 70 to 105 days

Taxonomic Class: Fine-loamy, mixed, superactive, frigid Aridic Argiustolls

Typical Pedon

Udecide sandy loam, in an area of Varney-Udecide-Geohrock complex, 4 to 15 percent slopes, in an area of rangeland, 1,350 feet north and 300 feet west of the southeast corner of sec. 22, T. 7 S., R. 8 W. Dillon East topographic quadrangle (lat. 45°12'27"N; long. 112°33'38"W)

- A—0 to 6 inches; brown (10YR 5/3) sandy loam, dark brown (10YR 3/3) moist; weak fine and medium subangular blocky structure parting to weak very fine and fine granular; soft, very friable, slightly sticky, slightly plastic; few fine and many very fine roots; neutral; clear smooth boundary.
- Bt—6 to 13 inches; yellowish brown (10YR 5/4) sandy clay loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate fine and

medium subangular blocky; slightly hard, friable, slightly sticky, slightly plastic; few fine and many very fine roots; many faint patchy clay films between sand grains and few faint patchy clay films on faces of peds; neutral; clear smooth boundary.

- Bk—13 to 29 inches; very pale brown (10YR 7/3) sandy loam, yellowish brown (10YR 5/4) moist; weak medium prismatic structure parting to weak fine and medium subangular blocky; soft, very friable, slightly sticky, nonplastic; few fine and common very fine roots; disseminated lime; common fine and medium soft masses of lime; violently effervescent; moderately alkaline; clear wavy boundary.
- Cr—29 to 60 inches; semiconsolidated sandstone that rubs to loamy sand.

Range in Characteristics

Mean annual soil temperature: 40 to 47 degrees F

Moisture control section: Between 4 and 12 inches; dry in all parts between four-tenths and five-tenths of the cumulative days per year when the soil temperature at a depth of 20 inches is 41 degrees F or higher

Depth to the argillic horizon: 4 to 8 inches

Depth to the Bk horizon: 10 to 17 inches

Depth to the Cr horizon: 20 to 40 inches

A horizon

Hue: 10YR or 2.5Y

Value: 5 dry; 3 moist

Chroma: 2 or 3

Texture: Sandy loam or clay loam

Clay content: 15 to 25 percent

Content of rock fragments: 0 to 35 percent—0 to 20 percent cobbles; 0 to 15 percent gravel

Reaction: pH 6.6 to 7.8

Bt horizon

Hue: 10YR or 2.5Y

Value: 4 to 6 dry; 3 or 4 moist

Chroma: 3 or 4

Texture: Sandy clay loam or clay loam

Clay content: 20 to 35 percent

Content of rock fragments: 0 to 20 percent—0 to 5 percent cobbles; 0 to 15 percent gravel

Reaction: pH 6.6 to 7.8

Bk horizon

Hue: 10YR or 2.5Y

Value: 6 or 7 dry; 5 moist

Chroma: 2 to 4

Texture: Sandy loam or sandy clay loam

Clay content: 10 to 25 percent

Content of rock fragments: 0 to 30 percent—0 to 5 percent cobbles; 0 to 25 percent gravel

Calcium carbonate equivalent: 10 to 20 percent

Reaction: pH 7.9 to 8.4

Varney Series

Depth class: Very deep

Drainage class: Well drained

Permeability: Moderate

Landform: Alluvial fans, hills, stream terraces, and escarpments

Parent material: Alluvium

Slope range: 0 to 35 percent

Elevation range: 4,500 to 6,500 feet

Annual precipitation: 10 to 14 inches

Annual air temperature: 38 to 42 degrees F

Frost-free period: 70 to 105 days

Taxonomic Class: Fine-loamy, mixed, superactive, frigid Calcic Argiustolls

Typical Pedon

Varney loam, in an area of Varney-Delpoint, stony-Geohrock complex, 4 to 35 percent slopes, in an area of rangeland, 200 feet north and 1,800 feet west of the southeast corner of sec. 28, T. 7 S., R. 8 W. Dillon East topographic quadrangle (lat. 45°11'22"N; long. 112°35'13"W)

A1—0 to 3 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; weak fine and medium subangular blocky structure parting to weak very fine and fine granular; soft, very friable, slightly sticky, slightly plastic; few medium, common fine, and many very fine roots; neutral; clear smooth boundary.

A2—3 to 6 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; few medium, common fine, and many very fine roots; neutral; clear smooth boundary.

Bt—6 to 12 inches; yellowish brown (10YR 5/4) clay loam, dark yellowish brown (10YR 4/4) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; slightly hard, friable, moderately sticky, moderately plastic; few medium, common fine, and many very fine roots; many faint patchy clay films on faces of peds and between sand grains; slightly alkaline; clear wavy boundary.

Bk1—12 to 36 inches; light brownish gray (10YR 6/2) loam, brown (10YR 5/3) moist; weak medium prismatic structure parting to moderate fine and medium subangular blocky; slightly hard, friable, slightly sticky, slightly plastic; few fine and common very fine roots; 5 percent gravel; disseminated lime; few fine and medium soft masses of lime; violently effervescent; moderately alkaline; clear wavy boundary.

Bk2—36 to 53 inches; pale brown (10YR 6/3) sandy loam, yellowish brown (10YR 5/4) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; common very fine roots; 5 percent gravel; disseminated lime; strongly effervescent; slightly alkaline; clear wavy boundary.

BC—53 to 60 inches; very pale brown (10YR 7/3) loam, brown (10YR 5/3) moist; massive; soft, very friable, slightly sticky, slightly plastic; few very fine roots; 5 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Mean annual soil temperature: 40 to 47 degrees F

Moisture control section: Between 4 and 12 inches; dry in all parts between four-tenths and five-tenths of the cumulative days per year when the soil temperature at a depth of 20 inches is 41 degrees F or higher

Depth to the Bk horizon: 10 to 23 inches

Thickness of the mollic epipedon: 7 to 16 inches; includes part of the argillic horizon

Surface stones: 0 to 0.1 percent

A horizons

Hue: 10YR or 2.5Y
Value: 4 or 5 dry; 2 or 3 moist
Chroma: 2 or 3
Texture: Clay loam, loam, or sandy clay loam
Clay content: 18 to 30 percent
Content of rock fragments: 0 to 25 percent—0 to 10 percent cobbles; 0 to 20 percent gravel
Electrical conductivity: 0 to 2 mmhos/cm
Reaction: pH 6.6 to 7.8

Bt horizon

Hue: 10YR or 2.5Y
Value: 4 to 6 dry; 3 to 5 moist
Chroma: 2 to 4
Texture: Clay loam or sandy clay loam
Clay content: 27 to 35 percent
Content of rock fragments: 0 to 35 percent—0 to 15 percent cobbles; 0 to 30 percent gravel
Electrical conductivity: 0 to 2 mmhos/cm
Reaction: pH 6.6 to 7.8

Bk1 horizon

Hue: 10YR or 2.5Y
Value: 6 or 7 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Sandy loam, loam, clay loam, or sandy clay loam
Clay content: 10 to 30 percent
Content of rock fragments: 0 to 35 percent—0 to 5 percent cobbles; 0 to 30 percent gravel
Calcium carbonate equivalent: 15 to 30 percent
Electrical conductivity: 0 to 2 mmhos/cm
Reaction: pH 7.4 to 8.4

Bk2 horizon

Hue: 10YR or 2.5Y
Value: 6 or 7 dry; 4 or 5 moist
Chroma: 3 or 4
Texture: Sandy loam, loam, or sandy clay loam
Clay content: 10 to 30 percent
Content of rock fragments: 0 to 35 percent—0 to 5 percent cobbles; 0 to 30 percent gravel
Calcium carbonate equivalent: 5 to 30 percent
Electrical conductivity: 0 to 2 mmhos/cm
Reaction: pH 7.4 to 8.4

BC horizon

Hue: 2.5Y, 10YR, or 7.5YR
Value: 6 or 7 dry; 4 or 5 moist
Chroma: 2 to 4
Texture: Stratified—loamy sand, sandy loam, sandy clay loam, or clay loam; not stratified—loam, sandy clay loam, or sandy loam
Clay content: 5 to 25 percent
Content of rock fragments: 5 to 35 percent—0 to 5 percent cobbles; 5 to 30 percent gravel
Electrical conductivity: 0 to 2 mmhos/cm

Calcium carbonate equivalent: 5 to 25 percent

Reaction: pH 7.4 to 8.4

Vendome Series

Depth class: Very deep

Drainage class: Well drained

Permeability: Moderately rapid through the Bk1 horizon; rapid in the 2Bk2 and 2Bk3 horizons

Landform: Alluvial fans, stream terraces, knolls, and plains

Parent material: Gravelly and cobbly alluvium

Slope range: 0 to 25 percent

Elevation range: 4,000 to 5,500 feet

Annual precipitation: 10 to 14 inches

Annual air temperature: 40 to 45 degrees F

Frost-free period: 90 to 115 days

Taxonomic Class: Sandy-skeletal, mixed, frigid Aridic Haplustolls

Typical Pedon

Vendome sandy loam, in an area of grassland, 750 feet south and 210 feet west of the northeast corner of sec. 15, T. 1 S., R. 5 W. Jefferson County, Montana.

A—0 to 6 inches; brown (10YR 5/3) sandy loam, dark brown (10YR 3/3) moist; moderate fine granular structure; slightly hard, friable, nonsticky, nonplastic; many very fine and fine roots; neutral; clear smooth boundary.

Bw—6 to 12 inches; brown (10YR 5/3) sandy loam, dark brown (10YR 4/3) moist; weak medium prismatic structure parting to moderate fine and medium subangular blocky; slightly hard, friable, nonsticky, nonplastic; common very fine and fine roots; neutral; gradual wavy boundary.

Bk1—12 to 18 inches; pale brown (10YR 6/3) cobbly sandy loam, brown (10YR 5/3) moist; weak fine and medium subangular blocky structure; soft, very friable, nonsticky, nonplastic; common very fine and fine roots; 20 percent cobbles, 5 percent gravel; thin lime coats on undersides of gravel; strongly effervescent; moderately alkaline; gradual wavy boundary.

2Bk2—18 to 30 inches; light brownish gray (10YR 6/2) extremely cobbly loamy sand, brown (10YR 5/3) moist; single grain; loose, nonsticky, nonplastic; few very fine roots; 35 percent cobbles, 40 percent gravel; thin lime coats around gravel; violently effervescent; strongly alkaline; clear smooth boundary.

2Bk3—30 to 60 inches; light brownish gray (10YR 6/2) extremely gravelly loamy sand, brown (10YR 5/3) moist; single grain; loose, nonsticky, nonplastic; few very fine roots; 15 percent cobbles, 60 percent gravel; thin lime coats around gravel; violently effervescent; strongly alkaline.

Wetsand Series

Depth class: Very deep

Drainage class: Poorly drained

Permeability: Moderate in the upper 14 inches and rapid below

Landform: Flood plains, flood plain steps, and drainageways

Parent material: Recent alluvium from mixed rock sources

Slope range: 0 to 2 percent

Elevation range: 4,800 to 6,000 feet

Annual precipitation: 10 to 14 inches

Annual air temperature: 40 to 44 degrees F

Frost-free period: 90 to 105 days

Taxonomic Class: Fine-loamy over sandy or sandy-skeletal, mixed, superactive, calcareous, frigid Aeric Fluvaquents

Typical Pedon

Wetsand loam, in an area of Clunton-Wetsand-Bonebasin complex, 0 to 2 percent slopes, in an area of rangeland, 1,000 feet south and 2,225 feet east of the northwest corner of sec. 9, T. 1 N., R. 3 W. Jefferson County, Montana.

- A1—0 to 2 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; soft, very friable, slightly sticky, slightly plastic; many very fine and fine roots; slightly effervescent; moderately alkaline; clear smooth boundary.
- A2—2 to 5 inches; light brownish gray (10YR 6/2) loam with thin strata of silty clay loam, silt loam and sandy loam, dark grayish brown (10YR 4/2) moist; strong fine granular structure; slightly hard, friable, moderately sticky, moderately plastic; many very fine and fine roots; disseminated lime; strongly effervescent; moderately alkaline; clear smooth boundary.
- AC—5 to 10 inches; pale brown (10YR 6/3) silt loam, dark grayish brown (10YR 4/2) moist; moderate medium and thick platy structure; soft, very friable, slightly sticky, slightly plastic; many very fine and fine roots; 15 percent rounded gravel; common fine prominent reddish brown (2.5YR 4/4) redox concentrations; disseminated lime; common faint carbonate coats on undersides of rock fragments; strongly effervescent; strongly alkaline; clear smooth boundary.
- C1—10 to 14 inches; brown (10YR 5/3) silt loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, friable, slightly sticky, slightly plastic; common very fine and fine roots; 15 percent rounded gravel; common fine prominent reddish brown (2.5YR 4/4) redox concentrations; disseminated lime; common distinct carbonate coats on rock fragments; slightly effervescent; moderately alkaline; clear smooth boundary.
- 2C2—14 to 60 inches; pale brown (10YR 6/3) extremely gravelly loamy sand, brown (10YR 5/3) moist; single grain; loose, nonsticky, nonplastic; few very fine roots; 15 percent rounded cobbles; 55 percent rounded gravel; disseminated lime; many distinct carbonate coats on rock fragments in upper 20 inches; slightly effervescent; moderately alkaline.

Range in Characteristics

Mean annual soil temperature: 42 to 46 degrees F

Moisture control section: Between 4 and 12 inches

Depth to the 2C horizon: 12 to 16 inches

Depth to the seasonal high water table: 12 to 24 inches

Soil phase: Saline

A horizons

Value: 4 to 6 dry; 3 or 4 moist

Chroma: 1 to 3

Texture: Clay loam, loam, or sandy loam with thin strata of silty clay loam, silt loam, very fine sandy loam, or fine sandy loam

Clay content: 6 to 35 percent

Content of rock fragments: 0 to 20 percent gravel

Electrical conductivity: 0 to 4 mmhos/cm; saline phase 4 to 16 mmhos/cm

Sodium adsorption ratio: 0 to 2; saline phase 4 to 13

Calcium carbonate equivalent: 0 to 5 percent; saline phase 3 to 10 percent
Reaction: pH 7.4 to 8.4; saline phase pH 8.5 to 9.0

AC horizon

Value: 5 or 6 dry
Chroma: 2 or 3
Texture: Loam, silt loam, or sandy loam
Clay content: 10 to 25 percent
Content of rock fragments: 0 to 25 percent gravel
Electrical conductivity: 0 to 4 mmhos/cm; saline phase 4 to 16 mmhos/cm
Sodium adsorption ratio: 0 to 2; saline phase 4 to 13
Calcium carbonate equivalent: 0 to 5 percent; saline phase 3 to 15 percent
Reaction: pH 7.4 to 8.4; saline phase pH 7.4 to 9.0

C1 horizon

Value: 5 to 7 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Sandy loam, loam, or silt loam
Clay content: 5 to 20 percent
Content of rock fragments: 0 to 35 percent—0 to 10 percent cobbles; 0 to 25 percent gravel
Electrical conductivity: 0 to 4 mmhos/cm; saline phase 4 to 16 mmhos/cm
Sodium adsorption ratio: 0 to 2; saline phase 4 to 13
Calcium carbonate equivalent: 0 to 5 percent; saline phase 3 to 15 percent
Reaction: pH 7.4 to 8.4; saline phase pH 7.4 to 9.0

2C2 horizon

Value: 5 to 8 dry; 4 to 7 moist
Chroma: 2 or 3
Texture: Loamy sand, sand, or coarse sand
Clay content: 0 to 10 percent
Content of rock fragments: 35 to 80 percent—5 to 20 percent cobbles; 30 to 60 percent gravel
Electrical conductivity: 0 to 2 mmhos/cm; saline phase 2 to 8 mmhos/cm
Sodium adsorption ratio: 0 to 2; saline phase 0 to 4
Calcium carbonate equivalent: 0 to 10 percent; saline phase 0 to 10 percent
Reaction: pH 7.4 to 8.4; saline phase pH 7.4 to 8.4

Whitlash Series

Depth class: Shallow

Drainage class: Well drained

Permeability: Moderate

Landform: Escarpments, ridges, and hills

Parent material: Residuum from hard sandstone or fine-grained igneous rock

Slope range: 4 to 60 percent

Elevation range: 5,500 to 6,200 feet

Annual precipitation: 15 to 19 inches

Annual air temperature: 36 to 40 degrees F

Frost-free period: 70 to 90 days

Taxonomic Class: Loamy-skeletal, mixed, superactive, frigid Lithic Haplustolls

Typical Pedon

Whitlash very cobbly loam, in an area of Whitlash-Whitlash, stony-Rock outcrop complex, 15 to 35 percent slopes, in an area of rangeland, 250 feet east and 900 feet north of the southwest corner of sec. 26, T. 4 N., R. 2 W. Jefferson County, Montana.

A—0 to 3 inches; dark grayish brown (10YR 4/2) very cobbly loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium granular structure; soft, very friable, slightly sticky, slightly plastic; many very fine and fine roots; 25 percent angular cobbles; 20 percent angular gravel; neutral; clear smooth boundary.

Bw—3 to 11 inches; grayish brown (10YR 5/2) extremely gravelly loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; many very fine and fine roots; slightly hard, very friable, slightly sticky, slightly plastic; 20 percent angular cobbles; 45 percent angular gravel, neutral; abrupt smooth boundary.

R—11 inches; hard, slightly fractured sandstone bedrock.

Range in Characteristics

Mean annual soil temperature: 38 to 42 degrees F

Moisture control section: Between 4 and 12 inches or between 4 inches and the lithic contact when bedrock is less than 12 inches

Thickness of the mollic epipedon: 7 to 10 inches

Depth to the lithic contact: 10 to 20 inches

Surface stones and boulders: 0 to 3 percent

A horizon

Hue: 7.5YR, 10YR, or 2.5Y

Value: 3 or 4 dry; 2 or 3 moist

Chroma: 1 to 3

Texture: Loam or coarse sandy loam

Clay content: 5 to 27 percent

Content of rock fragments: 15 to 60 percent—0 to 30 percent stones or cobbles; 15 to 35 percent gravel

Reaction: pH 6.1 to 7.3

Bw horizon

Hue: 7.5YR, 10YR, or 2.5Y

Value: 4 or 5 dry; 3 or 4 moist

Chroma: 2 or 3

Texture: Loam, sandy clay loam, or sandy loam

Clay content: 5 to 27 percent

Content of rock fragments: 35 to 80 percent—5 to 50 percent stones or cobbles; 15 to 60 percent gravel

Reaction: pH 6.1 to 7.3

Whitore Series

Depth class: Very deep

Drainage class: Well drained

Permeability: Moderate

Landform: Mountain slopes

Parent material: Colluvium derived from limestone

Slope range: 25 to 60 percent

Elevation range: 6,200 to 7,000 feet

Annual precipitation: 15 to 19 inches

Annual air temperature: 34 to 38 degrees F

Frost-free period: 30 to 70 days

Taxonomic Class: Loamy-skeletal, carbonatic Typic Eutrocryepts

Typical Pedon

Whitire gravelly loam, 25 to 60 percent slopes, stony, in an area of woodland, 1,800 feet west and 1,800 feet south of the northeast corner of sec. 21, T. 9 S., R. 8 W. Ashbough Canyon topographic quadrangle (lat. 45°02'17"N; long. 112°35'11"W)

Oi—0 to 2 inches; slightly decomposed forest litter.

A—2 to 6 inches; grayish brown (10YR 5/2) gravelly loam, dark grayish brown (10YR 4/2) moist; weak very fine, fine, and medium granular structure; slightly hard, very friable, slightly sticky, nonplastic; few very coarse, common medium and coarse, and many very fine and fine roots; 25 percent gravel; 5 percent channers; disseminated lime; strongly effervescent; moderately alkaline; clear wavy boundary.

Bw—6 to 18 inches; light brownish gray (10YR 6/2) very gravelly loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; hard, friable, moderately sticky, moderately plastic; few very coarse, common medium and coarse, and many very fine and fine roots; 35 percent gravel; 10 percent channers; disseminated lime; violently effervescent; moderately alkaline; gradual smooth boundary.

Bk1—18 to 45 inches; pale yellow (2.5Y 7/3) extremely gravelly loam, light olive brown (2.5Y 5/3) moist; weak coarse subangular blocky structure; very hard, friable, moderately sticky, moderately plastic; few medium, coarse, and very coarse and many very fine and fine roots; 60 percent gravel; 10 percent channers; common distinct lime casts surrounding rock fragments; disseminated lime; violently effervescent; moderately alkaline; gradual wavy boundary.

Bk2—45 to 60 inches; light yellowish brown (2.5Y 6/4) extremely channery sandy loam, light olive brown (2.5Y 5/4) moist; massive; soft, friable, moderately sticky, moderately plastic; few very fine, fine, and very coarse roots; 30 percent gravel; 40 percent channers; disseminated lime; violently effervescent; moderately alkaline.

Range in Characteristics

Mean annual soil temperature: 36 to 40 degrees F

Moisture control section: Between 4 and 12 inches

Depth to the Bk horizon: 5 to 17 inches

Surface stones and boulders: 0 to 0.1 percent

A horizon

Hue: 10YR or 2.5Y

Value: 4 to 6 dry; 2 to 4 moist

Chroma: 2 or 3

Clay content: 18 to 27 percent

Content of rock fragments: 5 to 35 percent gravel or channers

Calcium carbonate equivalent: 0 to 10 percent

Reaction: pH 6.6 to 8.4

Bw horizon

Hue: 10YR or 2.5Y

Value: 5 or 6 dry; 3 to 5 moist

Chroma: 2 or 3

Clay content: 18 to 27 percent

Content of rock fragments: 15 to 45 percent gravel or channers
 Calcium carbonate equivalent: 35 to 50 percent
 Reaction: pH 7.9 to 8.4

Bk horizons

Hue: 10YR or 2.5Y
 Value: 6 to 8 dry; 5 or 6 moist
 Chroma: 2 to 4
 Texture: Loam or sandy loam
 Clay content: 10 to 20 percent
 Content of rock fragments: 35 to 75 percent gravel or channers
 Calcium carbonate equivalent: 40 to 50 percent
 Reaction: pH 7.9 to 8.4

Wickes Series

Depth class: Moderately deep

Drainage class: Well drained

Permeability: Moderate

Landform: Escarpments, ridges, interfluvies, and hills

Parent material: Local colluvium, slope alluvium, and residuum from hard, fine-grained sandstone or fine-grained igneous rock

Slope range: 8 to 35 percent

Elevation range: 5,500 to 6,000 feet

Annual precipitation: 15 to 19 inches

Annual air temperature: 36 to 40 degrees F

Frost-free period: 70 to 90 days

Taxonomic Class: Loamy-skeletal, mixed, superactive, frigid Typic Argiustolls

Typical Pedon

Wickes very gravelly loam, in an area of Shawmut, bouldery-Wickes, stony-Tolbert, bouldery complex, 15 to 35 percent slopes, in an area of rangeland, 2,200 feet south and 1,500 feet west of the northeast corner of sec. 16, T. 9 N., R. 3 W. Jefferson County, Montana.

- A—0 to 8 inches; dark grayish brown (10YR 4/2) very gravelly loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure; soft, very friable, moderately sticky, slightly plastic; few fine and many very fine roots; many very fine and fine pores; 10 percent angular cobbles; 30 percent angular gravel; neutral; clear smooth boundary.
- Bt1—8 to 15 inches; brown (10YR 5/3) very gravelly clay loam, brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, moderately sticky, moderately plastic; few fine and many very fine roots; many very fine and fine pores; common distinct brown (10YR 4/3) clay films on faces of peds and bridging sand grains; 15 percent angular cobbles; 30 percent angular gravel; neutral; clear wavy boundary.
- Bt2—15 to 24 inches; light olive brown (2.5Y 5/4) very cobbly loam, olive brown (2.5Y 4/4) moist; weak very fine and fine subangular blocky structure; soft, very friable, moderately sticky, slightly plastic; many very fine and fine roots; many very fine and fine pores; few faint dark yellowish brown (10YR 4/4) clay films on faces of peds and bridging sand grains; 30 percent angular cobbles; 25 percent angular gravel; slightly alkaline; clear wavy boundary.
- Bk—24 to 30 inches; light yellowish brown (2.5Y 6/4) extremely cobbly loam, olive brown (2.5Y 4/4) moist; weak very fine and fine subangular blocky structure; soft,

very friable, slightly sticky, slightly plastic; common very fine roots; common very fine and fine pores; 40 percent angular cobbles; 25 percent angular gravel; disseminated lime; common fine masses of lime; common distinct carbonate coats on rock fragments; strongly effervescent; slightly alkaline.
R—30 inches; dark gray (10YR 4/1) hard, fine-grained igneous bedrock.

Range in Characteristics

Mean annual soil temperature: 38 to 42 degrees F

Moisture control section: Between 4 and 12 inches

Thickness of the mollic epipedon: 8 to 10 inches

Depth to the Bt horizon: 6 to 13 inches

Depth to the Bk horizon: 12 to 24 inches

Depth to the lithic contact: 20 to 40 inches

Surface stones and boulders: 0.01 to 3 percent

A horizon

Hue: 10YR or 2.5Y

Value: 4 or 5 dry; 2 or 3 moist

Chroma: 1 to 3

Clay content: 15 to 27 percent

Content of rock fragments: 15 to 45 percent—0 to 5 percent stones; 0 to 15 percent cobbles; 15 to 30 percent gravel

Reaction: pH 6.1 to 7.3

Bt horizons

Hue: 10YR or 2.5Y

Value: 4 or 5

Chroma: 2 to 4

Texture: Clay loam or loam

Clay content: 23 to 30 percent

Content of rock fragments: 35 to 60 percent—0 to 5 percent stones; 10 to 30 percent cobbles; 20 to 30 percent gravel

Reaction: pH 6.1 to 7.8

Bk horizon

Hue: 10YR or 2.5Y

Value: 5 to 8 dry; 4 to 7 moist

Chroma: 2 to 4

Texture: Loam or sandy loam

Clay content: 15 to 25 percent

Content of rock fragments: 35 to 70 percent—0 to 10 percent stones; 20 to 40 percent cobbles; 15 to 30 percent gravel

Calcium carbonate equivalent: 10 to 25 percent

Reaction: pH 7.4 to 8.4

Work Series

Depth class: Very deep

Drainage class: Well drained

Permeability: Moderately slow

Landform: Relict stream terraces, stream terraces, hills, alluvial fans, plains, and moraines

Parent material: Alluvium, colluvium, or glacial outwash

Slope range: 0 to 60 percent

Elevation range: 2,800 to 6,400 feet

Annual precipitation: 13 to 20 inches

Annual air temperature: 36 to 45 degrees F

Frost-free period: 70 to 130 days

Taxonomic Class: Fine, smectitic, frigid Typic Argiustolls

Typical Pedon

Work clay loam, in an area of cropland, 1,600 feet east and 500 feet south of the northwest corner of sec. 24, T. 27 N., R. 20 E. Blaine County, Montana.

Ap—0 to 6 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable, slightly sticky, moderately plastic; many fine roots; common unstained silt and sand grains; slightly alkaline; clear smooth boundary.

Bt—6 to 13 inches; dark brown (10YR 4/3) clay, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to strong fine and medium blocky; very hard, firm, moderately sticky, moderately plastic; many very fine and fine roots; common very fine and fine pores; continuous faint clay films; slightly alkaline; clear boundary.

Btk—13 to 19 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to weak medium blocky; hard, friable, moderately sticky, moderately plastic; common very fine and fine roots; common very fine and fine pores; common faint clay films on vertical faces of peds; 5 percent gravel; common masses of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bk1—19 to 29 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure; hard, friable, moderately sticky, moderately plastic; few to common fine roots; many very fine and fine pores; 10 percent gravel; many masses of lime; continuous distinct lime coats on gravel; violently effervescent; moderately alkaline; gradual wavy boundary.

Bk2—29 to 42 inches; pale brown (10YR 5/3) gravelly clay loam, dark brown (10YR 4/3) moist; massive; hard, friable, moderately sticky, slightly plastic; few very fine roots; many fine pores; 20 percent gravel; few masses of lime; continuous distinct lime coats on undersides of gravel; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bck—42 to 60 inches; pale brown (10YR 6/3) gravelly clay loam, dark brown (10YR 4/3) moist; massive; hard, friable, moderately sticky, slightly plastic; 30 percent gravel; disseminated lime; continuous distinct lime coats on undersides of gravel; strongly effervescent; moderately alkaline.

Worock Series

Depth class: Very deep

Drainage class: Well drained

Permeability: Moderately slow

Landform: Mountain slopes and hillsides

Parent material: Colluvium, alluvium, or till derived from igneous and metamorphic rock

Slope range: 25 to 65 percent

Elevation range: 6,100 to 8,100 feet

Annual precipitation: 20 to 24 inches

Annual air temperature: 35 to 45 degrees F

Frost-free period: 30 to 70 days

Taxonomic Class: Loamy-skeletal, mixed, superactive Eutric Haplocryalfs

Typical Pedon

Worock gravelly loam, 15 to 35 percent slopes, in an area of woodland, 300 feet south and 730 feet west of the northeast corner of sec. 18, T. 2 N., R. 12 W. Deer Lodge County, Montana.

Oi—0 to 1 inches; partially decomposed forest litter.

E—1 to 7 inches; light yellowish brown (10YR 6/4) gravelly loam, dark yellowish brown (10YR 4/4) moist; weak medium granular structure; slightly hard, friable, slightly sticky, slightly plastic; common medium roots and many very fine and fine roots; many very fine and fine irregular pores; 5 percent stones; 5 percent cobbles; 15 percent gravel; moderately acid; clear smooth boundary.

E/Bt—7 to 18 inches; E part (85 percent) very pale brown (10YR 7/4) sandy loam, Bt part (15 percent) yellowish brown (10YR 5/4) gravelly clay loam, yellowish brown (10YR 5/6) moist for both parts; weak medium granular structure; slightly hard, friable, slightly sticky, slightly plastic; few medium roots and many very fine and fine roots; many very fine irregular pores; 5 percent stones; 5 percent cobbles; 25 percent gravel; moderately acid; clear smooth boundary.

Bt—18 to 28 inches; yellowish brown (10YR 5/6) very gravelly clay loam, dark yellowish brown (10YR 4/6) moist; weak medium subangular blocky structure parting to weak medium granular; hard, firm, moderately sticky, moderately plastic; common very fine and fine roots; common very fine irregular pores; many distinct clay films on faces of peds; 5 percent stones; 10 percent cobbles; 30 percent gravel; moderately acid; clear smooth boundary.

BC—28 to 60 inches; light yellowish brown (10YR 6/4) very gravelly sandy clay loam, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, friable, moderately sticky, moderately plastic; few very fine and fine roots; few very fine irregular pores; 5 percent stones; 15 percent cobbles; 35 percent gravel; moderately acid.

Range in Characteristics

Soil temperature: 37 to 41 degrees F

Moisture control section: Between 4 and 12 inches

Depth to the argillic horizon: 6 to 20 inches

Surface stones: 0 to 3 percent

E horizon

Hue: 7.5YR, 10YR, or 2.5Y

Value: 6 or 7 dry; 3 to 5 moist

Chroma: 2 to 4 or 6

Texture: Loam or sandy loam

Clay content: 15 to 27 percent

Content of rock fragments: 10 to 50 percent—5 to 20 percent stones; 0 to 15 percent cobbles; 5 to 30 percent gravel

Reaction: pH 5.1 to 6.5

E/Bt horizon

Hue: E part 7.5YR, 10YR, or 2.5Y; Bt part 7.5YR or 10YR

Value: E part 6 or 7 dry; 3 to 5 moist; Bt part 5 or 6 dry; 4 or 5 moist

Chroma: E part 2 to 4, or 6; Bt part 4 or 6

Texture: E part: loam or sandy loam; Bt part: clay loam (mixed loam or clay loam)

Clay content: E part: 15 to 27 percent; Bt part: 27 to 30 percent; mixed 18 to 30 percent

Content of rock fragments: 20 to 60 percent—5 to 20 percent stones; 5 to 15 percent cobbles; 10 to 35 percent gravel

Reaction: pH 5.1 to 6.5

Bt horizon

Hue: 7.5YR or 10YR

Value: 5 to 7 dry; 4 or 5 moist

Chroma: 3, 4, or 6

Texture: Loam, clay loam, or sandy clay loam

Clay content: 25 to 35 percent

Content of rock fragments: 35 to 65 percent—0 to 10 percent stones; 5 to 15 percent cobbles; 25 to 45 percent gravel

Reaction: pH 5.6 to 6.5

BC horizon

Hue: 7.5YR or 10YR

Value: 6 or 7 dry; 4 to 6 moist

Chroma: 3, 4, or 6

Texture: Loam, clay loam, or sandy clay loam

Clay content: 12 to 35 percent

Content of rock fragments: 35 to 60 percent—5 to 10 percent stones; 5 to 15 percent cobbles; 25 to 45 percent gravel

Reaction: pH 5.6 to 6.5

Yamacall Series*Depth class:* Very deep*Drainage class:* Well drained*Permeability:* Moderate*Landform:* Alluvial fans, swales, and terraces*Parent material:* Alluvium derived from sedimentary rocks*Slope range:* 0 to 8 percent*Elevation range:* 4,800 to 6,800 feet*Annual precipitation:* 10 to 14 inches*Annual air temperature:* 38 to 42 degrees F*Frost-free period:* 90 to 105 days**Taxonomic Class:** Fine-loamy, mixed, superactive, frigid Aridic Haplustepts**Typical Pedon**

Yamacall loam, 0 to 4 percent slopes, in an area of cropland, 2,000 feet east and 1,700 feet south of the northwest corner of sec. 32, T. 7 S., R. 9 W. Dillon West topographic quadrangle (lat. 45°11'01"N; long. 112°44'07"W)

Ap—0 to 4 inches; brown (10YR 5/3) loam, brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; hard, very friable, slightly sticky, slightly plastic; many very fine and fine roots; disseminated lime; strongly effervescent; slightly alkaline; abrupt smooth boundary.

Bw—4 to 14 inches; pale brown (10YR 6/3) loam, brown (10YR 4/3) moist; moderate medium subangular blocky structure; hard, friable, slightly sticky, slightly plastic; many very fine and fine roots; disseminated lime; strongly effervescent; moderately alkaline; clear wavy boundary.

Bk1—14 to 26 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; moderate coarse subangular blocky structure; hard, very friable, slightly sticky, slightly plastic; common very fine and fine roots; common fine masses of lime; violently effervescent; moderately alkaline; clear wavy boundary.

Bk2—26 to 48 inches; light brownish gray (10YR 6/2) loam, grayish brown (10YR 5/2) moist; weak coarse subangular blocky structure; slightly hard, very friable,

slightly sticky, slightly plastic; few very fine roots; common fine masses of lime; violently effervescent; moderately alkaline; clear smooth boundary.
BC—48 to 60 inches; light yellowish brown (10YR 6/4) fine sandy loam, yellowish brown (10YR 5/4) moist; massive; soft, very friable, nonsticky, nonplastic; disseminated lime; strongly effervescent; moderately alkaline.

Range in Characteristics

Mean annual soil temperature: 40 to 47 degrees F

Moisture control section: Between 4 and 12 inches; dry in all parts between four-tenths and five-tenths of the cumulative days per year when the soil temperature at a depth of 20 inches is 41 degrees F or higher

Depth to the Bk horizon: 10 to 20 inches

Ap horizon

Hue: 10YR or 2.5Y

Value: 5 or 6 dry; 3 to 5 moist

Chroma: 2 or 3

Clay content: 18 to 27 percent

Content of rock fragments: 0 to 15 percent—0 to 5 percent cobbles; 0 to 10 percent gravel

Calcium carbonate equivalent: 0 to 10 percent

Reaction: pH 7.4 to 8.4

Bw horizon

Hue: 10YR or 2.5Y

Value: 5 to 7 dry; 4 to 6 moist

Chroma: 2 to 4

Texture: Loam or clay loam

Clay content: 18 to 30 percent

Content of rock fragments: 0 to 15 percent—0 to 5 percent cobbles; 0 to 10 percent gravel

Calcium carbonate equivalent: 0 to 15 percent

Reaction: pH 7.4 to 8.4

Bk horizons

Hue: 10YR or 2.5Y

Value: 6 or 7 dry; 5 or 6 moist

Chroma: 2 to 4

Texture: Loam, clay loam, or silt loam

Clay content: 18 to 30 percent

Content of rock fragments: 0 to 15 percent—0 to 5 percent cobbles; 0 to 10 percent gravel

Calcium carbonate equivalent: 5 to 15 percent

Reaction: pH 7.4 to 8.4

BC horizon

Hue: 10YR or 2.5Y

Value: 6 or 7 dry; 5 or 6 moist

Chroma: 2 to 4

Texture: Fine sandy loam or sandy loam

Clay content: 10 to 20 percent

Content of rock fragments: 0 to 15 percent—0 to 5 percent cobbles; 0 to 10 percent gravel

Calcium carbonate equivalent: 1 to 10 percent

Reaction: pH 7.9 to 8.4

Yetull Series

Depth class: Very deep

Drainage class: Somewhat excessively drained

Permeability: Rapid

Landform: Drainageways

Parent material: Alluvium derived from gneiss, schist, and granite

Slope range: 2 to 8 percent

Elevation range: 4,500 to 6,500 feet

Annual precipitation: 10 to 14 inches

Annual air temperature: 38 to 42 degrees F

Frost-free period: 90 to 105 days

Taxonomic Class: Mixed, frigid Aridic Ustipsamments

Typical Pedon

Yetull loamy sand, cool, 2 to 8 percent slopes, in an area of rangeland, 1,500 feet south and 900 feet west of the northeast corner of sec. 35, T. 4 S., R. 1 W. Madison County, Montana.

- A—0 to 8 inches; grayish brown (10YR 5/2) loamy sand, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable, nonsticky, nonplastic; many very fine and fine roots; 5 percent gravel; slightly alkaline; clear smooth boundary.
- C—8 to 60 inches; light brownish gray (10YR 6/2) loamy coarse sand, dark grayish brown (10YR 4/2) moist; single grain; loose, nonsticky, nonplastic; common very fine and fine roots; 15 percent gravel; slightly effervescent; moderately alkaline.

Range in Characteristics

Mean annual soil temperature: 40 to 47 degrees F

Moisture control section: Between 12 and 35 inches

Depth to carbonates: Typically less than 15 inches, but ranges as deep as 30 inches

A horizon

Hue: 10YR or 2.5Y

Value: 4 to 6 dry; 3 or 4 moist

Chroma: 2 to 4

Texture: Loamy sand, loamy coarse sand, fine sand, loamy fine sand, fine sandy loam, or sandy loam

Clay content: 0 to 10 percent

Content of rock fragments: 0 to 60 percent—0 to 10 percent cobbles; 0 to 55 percent gravel

Calcium carbonate equivalent: 0 to 10 percent

Effervescence: None to strongly

Reaction: pH 6.6 to 8.4

C horizon

Hue: 10YR or 2.5Y

Value: 4 to 6 dry; 3 to 5 moist

Chroma: 2 to 4

Texture: Sand, fine sand, loamy sand, loamy coarse sand, loamy fine sand, or coarse sand

Clay content: 0 to 10 percent

Content of rock fragments: 0 to 15 percent gravel

Calcium carbonate equivalent: 0 to 10 percent

Effervescence: None to strongly

Reaction: pH 7.4 to 8.4

Zbart Taxadjunct

Depth class: Very shallow

Drainage class: Somewhat excessively drained

Permeability: Moderate

Landform: Strike ridges, structural benches, and hills

Parent material: Residuum from interbedded sandstone and limestone

Slope range: 4 to 50 percent

Elevation range: 5,000 to 6,500 feet

Annual precipitation: 10 to 14 inches

Annual air temperature: 39 to 45 degrees F

Frost-free period: 70 to 90 days

Taxonomic Class: Loamy-skeletal, mixed, superactive, calcareous, frigid Aridic
Lithic Ustorthents

Typical Pedon

Zbart Taxadjunct very channery sandy loam, in an area of Haxby-Kalsted-Zbart complex, 4 to 15 percent slopes, in an area of rangeland, 1,850 feet south and 950 feet east of the northwest corner of sec. 8, T. 5 S., R. 9 W. Glen topographic quadrangle (lat. 45°25'03"N; long. 112°44'58"W)

A—0 to 3 inches; grayish brown (2.5Y 5/2) very channery sandy loam, olive brown (2.5Y 4/3) moist; weak fine and medium subangular blocky structure parting to weak fine granular; soft, very friable, slightly sticky, nonplastic; few fine and common very fine roots; common very fine and fine interstitial and tubular pores; 40 percent channers; slightly alkaline; clear smooth boundary.

C—3 to 6 inches; light yellowish brown (2.5Y 6/3) extremely channery sandy loam, olive brown (2.5Y 4/3) moist; weak fine granular structure; soft, very friable, slightly sticky, nonplastic; few fine and common very fine roots; common very fine and fine interstitial and tubular pores; 75 percent channers; strongly effervescent; slightly alkaline; clear smooth boundary.

R—6 inches; unweathered sandstone bedrock.

Range in Characteristics

Mean annual soil temperature: 42 to 46 degrees F; frigid soil temperature regime

Moisture control section: Between the surface and 6 inches; ustic soil moisture regime: dry in all parts between four-tenths and five-tenths of the cumulative days per year when the soil temperature at a depth of 20 inches is 41 degrees F or higher

Depth to the lithic contact: 5 to 10 inches

A horizon

Hue: 10YR or 2.5Y

Value: 4 or 5 dry; 3 or 4 moist

Chroma: 2 or 3

Texture: Sandy loam, coarse sandy loam, or loam

Clay content: 15 to 27 percent

Content of rock fragments: 35 to 60 percent—0 to 15 percent flagstones; 35 to 50 percent channers

Calcium carbonate equivalent: 0 to 5 percent

Reaction: pH 7.4 to 8.4

C horizon

Hue: 10YR or 2.5Y

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 to 4

Clay content: 15 to 27 percent

Content of rock fragments: 35 to 80 percent—0 to 20 percent flagstones; 35 to 75 percent channers

Calcium carbonate equivalent: 5 to 15 percent

Reaction: pH 7.6 to 8.4

Zonite Series

Depth class: Very shallow

Drainage class: Somewhat excessively drained

Permeability: Moderately rapid

Landform: Hillslopes, mountainflanks, ridges, and bedrock-floored pediments

Parent material: Residuum from granite or other coarse-grained igneous or metamorphic rocks

Slope range: 4 to 60 percent

Elevation range: 5,600 to 7,200 feet

Annual precipitation: 15 to 19 inches

Annual air temperature: 32 to 40 degrees F

Frost-free period: 30 to 70 days

Taxonomic Class: Sandy-skeletal, mixed Lithic Cryorthents

Typical Pedon

Zonite very gravelly coarse sandy loam, in an area of rangeland, 2,600 feet south and 1,300 feet east of the northwest corner of sec. 31, T. 3 N., R. 9 W. Burnt Mountain topographic quadrangle, UTM zone 12T, 0362750E, 5091903N, NAD 27. Silver Bow County, Montana.

A—0 to 4 inches; brown (10YR 5/3) very gravelly coarse sandy loam, brown (10YR 4/3) moist; weak fine granular structure; soft, very friable, slightly sticky, nonplastic; few fine and medium and common very fine roots; many very fine interstitial pores; 35 percent, mainly fine, gravel; slightly acid; clear wavy boundary.

BC—4 to 9 inches; yellowish brown (10YR 5/4) very gravelly loamy coarse sand, dark yellowish brown (10YR 4/4) moist; single grain; loose, nonsticky, nonplastic; few very fine and fine roots; common very fine interstitial pores; 45 percent, mainly fine, gravel; neutral; abrupt wavy boundary.

Cr—9 to 13 inches; soft, weathered granite bedrock.

R—13 inches; hard granite bedrock.

Detailed Soil Map Units

The map units delineated on the detailed soil maps in this survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this section, along with the maps, can be used to determine the suitability and potential of a unit for specific uses. They also can be used to plan the management needed for those uses.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class, there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. The contrasting components are mentioned in the map unit descriptions. A few areas of minor components may not have been observed, and, consequently, they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all of the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit.

Soils that have profiles that are almost alike make up a soil series. Except for differences in texture of the surface layer, all of the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into soil phases. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase

commonly indicates a feature that affects use or management. For example, Amesha loam, 0 to 4 percent slopes, is a phase of the Amesha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

This survey includes complexes. They consist of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Thess-Scravo complex, 0 to 4 percent slopes is an example.

This survey includes miscellaneous areas. They have little or no soil material and support little or no vegetation. Gravel pits is an example.

The "Acreage and Proportionate Extent of the Soils" table gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. Many of the terms used in describing the soils or miscellaneous areas are defined in the "Glossary."

1E—Kounter-Rock outcrop complex, 15 to 45 percent slopes

Map Unit Setting

Elevation: 5,800 to 6,400 feet

Mean annual precipitation: 12 to 19 inches

Frost-free period: 60 to 90 days

Component Description

Kounter and similar soils

Composition: 50 percent

Geomorphic description: Hill

Slope: 15 to 45 percent

Elevation: 5,800 to 6,400 feet

Effective annual precipitation: 12 to 19 inches

Frost-free period: 70 to 90 days

Surface layer texture: Gravelly sandy loam

Depth to restrictive feature:

- *Bedrock (paralithic):* 10 to 18 inches
- *Bedrock (lithic):* 12 to 20 inches

Drainage class: Somewhat excessively drained

Parent material: Colluvium and/or residuum derived from gneiss and/or schist

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 0.8 inches

Rock outcrop

Composition: 35 percent

Additional Components

Branham and similar soils: 7 percent

Zbart and similar soils: 7 percent

Tibkey and similar soils: 1 percent

2D—Kounter-Rock outcrop complex, 4 to 15 percent slopes

Map Unit Setting

Elevation: 5,900 to 6,500 feet

Mean annual precipitation: 12 to 19 inches

Frost-free period: 50 to 90 days

Component Description

Kounter and similar soils

Composition: 70 percent

Geomorphic description: Strike ridge and hillside

Slope: 4 to 15 percent

Elevation: 5,900 to 6,500 feet

Effective annual precipitation: 12 to 19 inches

Frost-free period: 70 to 90 days

Surface layer texture: Gravelly sandy loam

Depth to restrictive feature:

- *Bedrock (paralithic):* 10 to 18 inches
- *Bedrock (lithic):* 12 to 20 inches

Drainage class: Somewhat excessively drained

Parent material: Colluvium and/or residuum derived from gneiss and/or schist

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 0.8 inches

Rock outcrop

Composition: 15 percent

Additional Components

Branham and similar soils: 5 percent

Kounter, stony and similar soils: 5 percent

Nieman and similar soils: 5 percent

4E—Libeg, very stony-Oro Fino-Poin, stony complex, 15 to 60 percent slopes

Map Unit Setting

Elevation: 6,100 to 7,800 feet

Mean annual precipitation: 15 to 24 inches

Frost-free period: 30 to 70 days

Component Description

Libeg and similar soils

Composition: 40 percent

Geomorphic description: Mountain slope

Slope: 25 to 60 percent

Elevation: 6,100 to 7,800 feet

Effective annual precipitation: 15 to 24 inches

Frost-free period: 30 to 70 days

Surface layer texture: Cobbly loam

Rock fragments on the soil surface: 0.10 to 3.00 percent stones

Depth to restrictive feature: None noted

Drainage class: Well drained

Parent material: Colluvium

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 4.2 inches

Oro Fino and similar soils

Composition: 20 percent

Geomorphic description: Hillside

Slope: 15 to 45 percent

Elevation: 6,100 to 7,800 feet

Effective annual precipitation: 15 to 24 inches

Frost-free period: 30 to 70 days

Surface layer texture: Loam

Depth to restrictive feature: None noted

Drainage class: Well drained

Parent material: Colluvium and alluvium

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 6.3 inches

Poin and similar soils

Composition: 15 percent

Geomorphic description: Mountain slope

Slope: 20 to 50 percent

Elevation: 6,100 to 7,800 feet

Effective annual precipitation: 15 to 24 inches

Frost-free period: 30 to 70 days

Surface layer texture: Very cobbly loam

Rock fragments on the soil surface: 0.01 to 0.10 percent stones

Depth to restrictive feature: Bedrock (lithic): 10 to 20 inches

Drainage class: Well drained

Parent material: Colluvium over residuum weathered from gneiss and/or residuum weathered from schist

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 1.4 inches

Additional Components

Barbarela and similar soils: 6 percent

Nathale and similar soils: 6 percent

Rock outcrop: 6 percent

Worock and similar soils: 6 percent

Tibkey and similar soils: 1 percent

5E—Barbarela-Poin, flaggy complex, 15 to 35 percent slopes

Map Unit Setting

Elevation: 5,800 to 7,500 feet

Mean annual precipitation: 12 to 19 inches

Frost-free period: 30 to 80 days

Component Description

Barbarela and similar soils

Composition: 60 percent

Geomorphic description: Hillside

Slope: 15 to 35 percent

Elevation: 6,400 to 7,500 feet

Effective annual precipitation: 12 to 19 inches

Frost-free period: 30 to 70 days

Surface layer texture: Sandy loam

Depth to restrictive feature:

- *Bedrock (paralithic):* 20 to 40 inches
- *Bedrock (lithic):* 25 to 60 inches

Drainage class: Well drained

Parent material: Colluvium over residuum weathered from gneiss and/or residuum weathered from schist

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 4.9 inches

Poin and similar soils

Composition: 20 percent

Geomorphic description: Hillside

Slope: 15 to 35 percent

Elevation: 6,400 to 7,500 feet

Effective annual precipitation: 12 to 19 inches

Frost-free period: 30 to 70 days

Surface layer texture: Channery sandy loam

Rock fragments on the soil surface: 0.01 to 0.10 percent flagstones

Depth to restrictive feature: Bedrock (lithic): 10 to 20 inches

Drainage class: Well drained

Parent material: Colluvium over residuum weathered from gneiss and/or residuum weathered from schist

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 1.6 inches

Additional Components

Branham and similar soils: 5 percent

Kounter and similar soils: 5 percent

Rock outcrop: 5 percent

Nieman and similar soils: 4 percent

Finn and similar soils: 1 percent

6E—Cheadle family, very stony-Rock outcrop complex, 25 to 60 percent slopes

Map Unit Setting

Elevation: 6,100 to 7,200 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 30 to 70 days

Component Description

Cheadle and similar soils

Composition: 45 percent
Geomorphic description: Hillside
Slope: 25 to 60 percent
Elevation: 6,100 to 7,200 feet
Effective annual precipitation: 15 to 19 inches
Frost-free period: 30 to 70 days
Surface layer texture: Very gravelly loam
Rock fragments on the soil surface: 0.10 to 3.00 percent stones
Depth to restrictive feature: Bedrock (lithic): 10 to 20 inches
Drainage class: Well drained
Parent material: Colluvium over residuum weathered from gneiss and/or residuum weathered from schist
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.6 inches

Rock outcrop

Composition: 35 percent

Additional Components

Libeg and similar soils: 9 percent
Surdal and similar soils: 6 percent
Poin and similar soils: 3 percent
Nieman and similar soils: 2 percent

7B—Trudau loam, cool, 2 to 8 percent slopes

Map Unit Setting

Elevation: 5,600 to 6,100 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 70 to 90 days

Component Description

Trudau and similar soils

Composition: 85 percent
Geomorphic description: Alluvial fan and stream terrace
Slope: 2 to 8 percent
Elevation: 5,600 to 6,100 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 70 to 90 days
Surface layer texture: Loam

Depth to restrictive feature: None noted
Drainage class: Well drained
Parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 5.8 inches

Additional Components

Kalsted and similar soils: 5 percent
Sappington and similar soils: 5 percent
Thess and similar soils: 5 percent

8A—Beavrock-Ashbough complex, 0 to 2 percent slopes

Map Unit Setting

Elevation: 5,600 to 6,500 feet
Mean annual precipitation: 12 to 14 inches
Frost-free period: 70 to 90 days

Component Description

Beavrock and similar soils

Composition: 35 percent
Geomorphic description: Flood plain and slough
Slope: 0 to 2 percent
Elevation: 5,600 to 6,500 feet
Effective annual precipitation: 12 to 14 inches
Frost-free period: 70 to 90 days
Surface layer texture: Silt loam
Depth to restrictive feature: None noted
Drainage class: Poorly drained
Parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Occasional
Water table: Present
Available water capacity: Mainly 5.4 inches

Ashbough and similar soils

Composition: 25 percent
Geomorphic description: Flood plain and stream terrace
Slope: 0 to 2 percent
Elevation: 5,600 to 6,500 feet
Effective annual precipitation: 12 to 14 inches
Frost-free period: 70 to 90 days
Surface layer texture: Loam
Depth to restrictive feature: None noted
Drainage class: Moderately well drained
Parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare
Water table: Present
Available water capacity: Mainly 9.9 inches

Additional Components

Fairway and similar soils: 10 percent
Threeriv and similar soils: 10 percent
Neen and similar soils: 8 percent
Newtman and similar soils: 5 percent
Dillon and similar soils: 3 percent
Madbeaver and similar soils: 3 percent
Water: 1 percent

9B—Threeriv-Beavrock complex, 0 to 2 percent slopes

Map Unit Setting

Elevation: 5,600 to 6,500 feet
Mean annual precipitation: 12 to 14 inches
Frost-free period: 70 to 90 days

Component Description

Threeriv and similar soils

Composition: 50 percent
Geomorphic description: Marsh
Slope: 0 to 2 percent
Elevation: 5,600 to 6,500 feet
Effective annual precipitation: 12 to 14 inches
Frost-free period: 70 to 90 days
Surface layer texture: Silt loam
Depth to restrictive feature: None noted
Drainage class: Very poorly drained
Parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Frequent
Water table: Present
Available water capacity: Mainly 5.0 inches

Beavrock and similar soils

Composition: 25 percent
Geomorphic description: Flood plain
Slope: 0 to 2 percent
Elevation: 5,600 to 6,500 feet
Effective annual precipitation: 12 to 14 inches
Frost-free period: 70 to 90 days
Surface layer texture: Silt loam
Depth to restrictive feature: None noted
Drainage class: Poorly drained
Parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Occasional
Water table: Present
Available water capacity: Mainly 5.4 inches

Additional Components

Fairway and similar soils: 10 percent
Water: 10 percent

Ashbough and similar soils: 3 percent

Newtman and similar soils: 2 percent

10B—Ryell-Rivra complex, 0 to 4 percent slopes

Map Unit Setting

Elevation: 4,800 to 5,600 feet

Mean annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Component Description

Ryell and similar soils

Composition: 55 percent

Geomorphic description: Flood plain

Slope: 0 to 4 percent

Elevation: 4,800 to 5,600 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Loam

Depth to restrictive feature: None noted

Drainage class: Well drained

Parent material: Alluvium

Native plant cover type: Rangeland

Flooding: Rare

Water table: Present

Available water capacity: Mainly 4.3 inches

Rivra and similar soils

Composition: 35 percent

Geomorphic description: Flood plain

Slope: 0 to 4 percent

Elevation: 4,800 to 5,600 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Gravelly loam

Depth to restrictive feature: None noted

Drainage class: Well drained

Parent material: Alluvium

Native plant cover type: Rangeland

Flooding: Frequent

Water table: Present

Available water capacity: Mainly 2.4 inches

Additional Components

Havre and similar soils: 3 percent

Thess and similar soils: 3 percent

Water: 2 percent

Beavrock and similar soils: 1 percent

Threeriv and similar soils: 1 percent

10D—Crago complex, 4 to 10 percent slopes

Map Unit Setting

Elevation: 5,600 to 6,100 feet

Mean annual precipitation: 12 to 14 inches

Frost-free period: 70 to 90 days

Component Description

Crago, stony and similar soils

Composition: 50 percent

Geomorphic description: Alluvial fan

Slope: 4 to 10 percent

Elevation: 5,600 to 6,100 feet

Effective annual precipitation: 12 to 14 inches

Frost-free period: 70 to 90 days

Surface layer texture: Gravelly loam

Rock fragments on the soil surface: 0.01 to 0.10 percent stones

Depth to restrictive feature: None noted

Drainage class: Well drained

Parent material: Alluvium derived from limestone

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 2.8 inches

Crago and similar soils

Composition: 20 percent

Geomorphic description: Alluvial fan

Slope: 4 to 8 percent

Elevation: 5,600 to 6,100 feet

Effective annual precipitation: 12 to 14 inches

Frost-free period: 70 to 90 days

Surface layer texture: Loam

Depth to restrictive feature: None noted

Drainage class: Well drained

Parent material: Alluvium derived from limestone

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 3.0 inches

Crago, very stony and similar soils

Composition: 15 percent

Geomorphic description: Alluvial fan

Slope: 4 to 8 percent

Elevation: 5,600 to 6,100 feet

Effective annual precipitation: 12 to 14 inches

Frost-free period: 70 to 90 days

Surface layer texture: Cobbly loam

Rock fragments on the soil surface: 0.10 to 3.00 percent stones

Depth to restrictive feature: None noted

Drainage class: Well drained

Parent material: Alluvium derived from limestone

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 2.9 inches

Additional Components

Crago and similar soils: 8 percent

Amesha and similar soils: 5 percent

Beavrock and similar soils: 1 percent

Neen and similar soils: 1 percent

11B—Rivra, cool-Beavrock complex, 0 to 4 percent slopes

Map Unit Setting

Elevation: 4,800 to 6,000 feet

Mean annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Component Description

Rivra and similar soils

Composition: 45 percent

Geomorphic description: Flood plain

Slope: 0 to 4 percent

Elevation: 4,800 to 6,000 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Gravelly sandy loam

Depth to restrictive feature: None noted

Drainage class: Well drained

Parent material: Mixed alluvium

Native plant cover type: Rangeland

Flooding: Frequent

Water table: Present

Available water capacity: Mainly 2.2 inches

Beavrock and similar soils

Composition: 40 percent

Geomorphic description: Flood plain

Slope: 0 to 4 percent

Elevation: 4,800 to 6,000 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Silt loam

Depth to restrictive feature: None noted

Drainage class: Poorly drained

Parent material: Alluvium

Native plant cover type: Rangeland

Flooding: Occasional

Water table: Present

Available water capacity: Mainly 5.4 inches

Additional Components

Dillon and similar soils: 5 percent

Water: 3 percent

Ryell and similar soils: 2 percent

Threeriv and similar soils: 2 percent
 Wetsand and similar soils: 2 percent
 Riverwash: 1 percent

11D—Barbarela-Foolhen complex, 2 to 15 percent slopes

Map Unit Setting

Elevation: 5,900 to 7,500 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 30 to 70 days

Component Description

Barbarela and similar soils

Composition: 55 percent
Geomorphic description: Hillside
Slope: 2 to 15 percent
Elevation: 5,900 to 7,500 feet
Effective annual precipitation: 15 to 19 inches
Frost-free period: 30 to 70 days
Surface layer texture: Sandy loam
Depth to restrictive feature:

- *Bedrock (paralithic):* 20 to 40 inches
- *Bedrock (lithic):* 25 to 60 inches

Drainage class: Well drained
Parent material: Colluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.9 inches

Foolhen and similar soils

Composition: 25 percent
Geomorphic description: Drainageway and flood plain
Slope: 2 to 8 percent
Elevation: 5,900 to 7,500 feet
Effective annual precipitation: 15 to 19 inches
Frost-free period: 30 to 70 days
Surface layer texture: Loam
Depth to restrictive feature: None noted
Drainage class: Very poorly drained
Parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Occasional
Water table: Present
Available water capacity: Mainly 8.9 inches

Additional Components

Finn and similar soils: 6 percent
 Adel and similar soils: 5 percent
 Oro Fino and similar soils: 4 percent
 Tibkey and similar soils: 2 percent
 Poin and similar soils: 1 percent
 Rock outcrop: 1 percent
 Water: 1 percent

12C—Attewan cobbly loam, cool, 2 to 8 percent slopes**Map Unit Setting**

Elevation: 4,500 to 6,500 feet

Mean annual precipitation: 10 to 14 inches

Frost-free period: 80 to 105 days

Component Description**Attewan and similar soils**

Composition: 85 percent

Geomorphic description: Alluvial fan and stream terrace

Slope: 2 to 8 percent

Elevation: 4,500 to 6,500 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Cobbly loam

Depth to restrictive feature: None noted

Drainage class: Well drained

Parent material: Loamy alluvium over sandy and gravelly alluvium

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 3.9 inches

Additional Components

Beaverell and similar soils: 5 percent

Trimad and similar soils: 5 percent

Varney and similar soils: 5 percent

14E—Hanson complex, 8 to 25 percent slopes**Map Unit Setting**

Elevation: 5,600 to 6,500 feet

Mean annual precipitation: 15 to 19 inches

Frost-free period: 30 to 70 days

Component Description**Hanson, very bouldery and similar soils**

Composition: 40 percent

Geomorphic description: Alluvial fan

Slope: 8 to 25 percent

Elevation: 5,600 to 6,500 feet

Effective annual precipitation: 15 to 19 inches

Frost-free period: 30 to 70 days

Surface layer texture: Gravelly loam

Rock fragments on the soil surface: 0.10 to 3.00 percent boulders

Depth to restrictive feature: None noted

Drainage class: Well drained

Parent material: Alluvium and/or colluvium

Flooding: None

Available water capacity: Mainly 5.3 inches

Hanson, stony and similar soils*Composition:* 30 percent*Geomorphic description:* Alluvial fan*Slope:* 8 to 15 percent*Elevation:* 5,600 to 6,500 feet*Effective annual precipitation:* 15 to 19 inches*Frost-free period:* 30 to 70 days*Surface layer texture:* Gravelly loam*Rock fragments on the soil surface:* 0.01 to 0.10 percent stones*Depth to restrictive feature:* None noted*Drainage class:* Well drained*Parent material:* Alluvium and/or colluvium*Flooding:* None*Available water capacity:* Mainly 5.3 inches**Hanson and similar soils***Composition:* 15 percent*Geomorphic description:* Alluvial fan*Slope:* 8 to 15 percent*Elevation:* 5,600 to 6,500 feet*Effective annual precipitation:* 15 to 19 inches*Frost-free period:* 30 to 70 days*Surface layer texture:* Gravelly loam*Depth to restrictive feature:* None noted*Drainage class:* Well drained*Parent material:* Alluvium and/or colluvium*Flooding:* None*Available water capacity:* Mainly 5.3 inches**Additional Components**

Libeg and similar soils: 8 percent

Tiban and similar soils: 7 percent

15B—Glendive sandy loam, 0 to 4 percent slopes**Map Unit Setting***Elevation:* 4,800 to 5,400 feet*Mean annual precipitation:* 10 to 14 inches*Frost-free period:* 90 to 105 days**Component Description****Glendive and similar soils***Composition:* 85 percent*Geomorphic description:* Stream terrace*Slope:* 0 to 4 percent*Elevation:* 4,800 to 5,400 feet*Effective annual precipitation:* 10 to 14 inches*Frost-free period:* 90 to 105 days*Surface layer texture:* Sandy loam*Depth to restrictive feature:* None noted*Drainage class:* Well drained*Parent material:* Alluvium*Native plant cover type:* Rangeland

Flooding: None

Available water capacity: Mainly 7.9 inches

Additional Components

Glendive, saline and similar soils: 5 percent

Ryell and similar soils: 4 percent

Dillon and similar soils: 2 percent

Havre and similar soils: 2 percent

Beavrock and similar soils: 1 percent

Rivra and similar soils: 1 percent

17A—Beavwan-Sieberell complex, 1 to 4 percent slopes

Map Unit Setting

Elevation: 5,800 to 6,300 feet

Mean annual precipitation: 12 to 14 inches

Frost-free period: 70 to 90 days

Component Description

Beavwan and similar soils

Composition: 55 percent

Geomorphic description: Alluvial fan

Slope: 1 to 4 percent

Elevation: 5,800 to 6,300 feet

Effective annual precipitation: 12 to 14 inches

Frost-free period: 70 to 90 days

Surface layer texture: Gravelly sandy loam

Depth to restrictive feature: None noted

Drainage class: Well drained

Parent material: Alluvium

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 4.1 inches

Sieberell and similar soils

Composition: 25 percent

Geomorphic description: Alluvial fan

Slope: 1 to 4 percent

Elevation: 5,800 to 6,300 feet

Effective annual precipitation: 12 to 14 inches

Frost-free period: 70 to 90 days

Surface layer texture: Cobbly loam

Depth to restrictive feature: None noted

Drainage class: Well drained

Parent material: Alluvium

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 3.1 inches

Additional Components

Rivra and similar soils: 8 percent

Beavwan, very stony and similar soils: 5 percent

Varney and similar soils: 5 percent

Scravo and similar soils: 2 percent

18E—Libeg, stony-Poin, very stony-Rock outcrop complex, 25 to 60 percent slopes

Map Unit Setting

Elevation: 6,700 to 8,500 feet

Mean annual precipitation: 15 to 24 inches

Frost-free period: 30 to 70 days

Component Description

Libeg and similar soils

Composition: 50 percent

Geomorphic description: Mountain slope

Slope: 25 to 60 percent

Elevation: 6,700 to 8,500 feet

Effective annual precipitation: 15 to 24 inches

Frost-free period: 30 to 70 days

Surface layer texture: Cobbly loam

Rock fragments on the soil surface: 0.01 to 0.10 percent stones

Depth to restrictive feature: None noted

Drainage class: Well drained

Parent material: Gravelly alluvium

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 4.2 inches

Poin and similar soils

Composition: 15 percent

Geomorphic description: Mountain slope

Slope: 25 to 60 percent

Elevation: 6,700 to 8,500 feet

Effective annual precipitation: 15 to 24 inches

Frost-free period: 30 to 70 days

Surface layer texture: Very cobbly loam

Rock fragments on the soil surface: 0.10 to 3.00 percent stones

Depth to restrictive feature: Bedrock (lithic): 10 to 20 inches

Drainage class: Well drained

Parent material: Colluvium over residuum weathered from gneiss and/or residuum weathered from schist

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 1.4 inches

Rock outcrop

Composition: 10 percent

Additional Components

Nieman and similar soils: 9 percent

Adel and similar soils: 6 percent

Bavdark and similar soils: 4 percent

Worock and similar soils: 3 percent
Sebud and similar soils: 2 percent
Tibkey and similar soils: 1 percent

19D—Blaine stony loam, 2 to 15 percent slopes

Map Unit Setting

Elevation: 6,000 to 7,500 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 50 to 80 days

Component Description

Blaine and similar soils

Composition: 85 percent
Geomorphic description: Hillside and ridge
Slope: 2 to 15 percent
Elevation: 6,000 to 7,500 feet
Effective annual precipitation: 15 to 19 inches
Frost-free period: 50 to 70 days
Surface layer texture: Stony loam
Depth to restrictive feature: Bedrock (lithic): 20 to 40 inches
Drainage class: Well drained
Parent material: Colluvium derived from argillite and/or residuum weathered from metaquartzite
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.4 inches

Additional Components

Leavitt and similar soils: 8 percent
Adel and similar soils: 5 percent
Rock outcrop: 2 percent

20F—Whitore gravelly loam, 25 to 60 percent slopes, stony

Map Unit Setting

Elevation: 6,200 to 7,000 feet
Mean annual precipitation: 20 to 24 inches
Frost-free period: 30 to 70 days

Component Description

Whitore and similar soils

Composition: 80 percent
Geomorphic description: Mountainflank on mountain
Slope: 25 to 60 percent
Elevation: 6,200 to 7,000 feet
Effective annual precipitation: 20 to 24 inches
Frost-free period: 30 to 70 days
Surface layer texture: Gravelly loam
Rock fragments on the soil surface: 0.01 to 0.10 percent stones

Depth to restrictive feature: None noted
Drainage class: Well drained
Parent material: Colluvium
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 4.6 inches

Additional Components

Firada and similar soils: 10 percent
Rock outcrop (calcareous sandstone): 10 percent

21B—Thess loam, cool, 0 to 4 percent slopes

Map Unit Setting

Elevation: 5,900 to 6,200 feet
Mean annual precipitation: 12 to 14 inches
Frost-free period: 70 to 90 days

Component Description

Thess and similar soils

Composition: 90 percent
Geomorphic description: Stream terrace
Slope: 0 to 4 percent
Elevation: 5,900 to 6,200 feet
Effective annual precipitation: 12 to 14 inches
Frost-free period: 70 to 90 days
Surface layer texture: Loam
Depth to restrictive feature: None noted
Drainage class: Well drained
Parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 6.3 inches

Additional Components

Amesha and similar soils: 3 percent
Trudau and similar soils: 3 percent
Neen and similar soils: 2 percent
Thessvo and similar soils: 2 percent

22E—Tiban, very stony-Maciver complex, 15 to 60 percent slopes

Map Unit Setting

Elevation: 6,200 to 7,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 30 to 70 days

Component Description

Tiban and similar soils

Composition: 45 percent

Geomorphic description: Moraine

Slope: 15 to 60 percent

Elevation: 6,200 to 7,000 feet

Effective annual precipitation: 15 to 19 inches

Frost-free period: 30 to 70 days

Surface layer texture: Very cobbly loam

Rock fragments on the soil surface: 0.10 to 3.00 percent stones

Depth to restrictive feature: None noted

Drainage class: Well drained

Parent material: Alpine till

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 5.6 inches

Maciver and similar soils

Composition: 40 percent

Geomorphic description: Moraine

Slope: 15 to 60 percent

Elevation: 6,200 to 7,000 feet

Effective annual precipitation: 15 to 19 inches

Frost-free period: 30 to 70 days

Surface layer texture: Cobbly loam

Depth to restrictive feature: None noted

Drainage class: Well drained

Parent material: Alpine till

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 5.3 inches

Additional Components

Bavdark and similar soils: 5 percent

Philipsburg and similar soils: 5 percent

Hanson and similar soils: 3 percent

Foolhen and similar soils: 2 percent

23B—Newtman-Dougcliff complex, 0 to 4 percent slopes

Map Unit Setting

Elevation: 5,800 to 6,200 feet

Mean annual precipitation: 12 to 14 inches

Frost-free period: 70 to 90 days

Component Description

Newtman and similar soils

Composition: 50 percent

Geomorphic description: Marsh

Slope: 0 to 2 percent

Elevation: 5,800 to 6,200 feet

Effective annual precipitation: 12 to 14 inches

Frost-free period: 70 to 90 days
Surface layer texture: Mucky peat
Depth to restrictive feature: None noted
Drainage class: Very poorly drained
Parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Water table: Present
Available water capacity: Mainly 7.1 inches

Dougcliff and similar soils

Composition: 30 percent
Geomorphic description: Marsh
Slope: 0 to 1 percent
Elevation: 5,800 to 6,200 feet
Effective annual precipitation: 12 to 14 inches
Frost-free period: 70 to 90 days
Surface layer texture: Peat
Depth to restrictive feature: None noted
Drainage class: Very poorly drained
Parent material: Alluvium
Flooding: None
Water table: Present
Available water capacity: Mainly 15.8 inches

Additional Components

Fairway and similar soils: 10 percent
 Blossberg and similar soils: 6 percent
 Beavrock and similar soils: 4 percent

23C—Bridger clay loam, 2 to 8 percent slopes

Map Unit Setting

Elevation: 6,500 to 8,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 50 to 90 days

Component Description

Bridger and similar soils

Composition: 80 percent
Geomorphic description: Footslope on hill and stream terrace
Slope: 2 to 8 percent
Elevation: 6,500 to 8,000 feet
Effective annual precipitation: 15 to 19 inches
Frost-free period: 50 to 90 days
Surface layer texture: Clay loam
Depth to restrictive feature: None noted
Drainage class: Well drained
Parent material: Clayey alluvium and/or clayey glaciomarine deposits
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 6.8 inches

Additional Components

Bridger, loam and similar soils: 10 percent

Adel and similar soils: 5 percent

Leavitt and similar soils: 5 percent

24C—Kalsted-Sappington complex, 2 to 8 percent slopes**Map Unit Setting**

Elevation: 5,800 to 6,700 feet

Mean annual precipitation: 12 to 14 inches

Frost-free period: 70 to 90 days

Component Description**Kalsted and similar soils**

Composition: 55 percent

Geomorphic description: Alluvial fan

Slope: 2 to 8 percent

Elevation: 5,800 to 6,700 feet

Effective annual precipitation: 12 to 14 inches

Frost-free period: 70 to 90 days

Surface layer texture: Gravelly sandy loam

Depth to restrictive feature: None noted

Drainage class: Well drained

Parent material: Alluvium

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 6.9 inches

Sappington and similar soils

Composition: 20 percent

Geomorphic description: Alluvial fan and swale

Slope: 2 to 8 percent

Elevation: 5,800 to 6,700 feet

Effective annual precipitation: 12 to 14 inches

Frost-free period: 70 to 90 days

Surface layer texture: Loam

Depth to restrictive feature: None noted

Drainage class: Well drained

Parent material: Alluvium

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 8.3 inches

Additional Components

Bronec and similar soils: 8 percent

Amesha and similar soils: 4 percent

Attewan and similar soils: 4 percent

Yamacall and similar soils: 3 percent

Nippt and similar soils: 2 percent

Thess and similar soils: 2 percent

Trimad and similar soils: 2 percent

25E—Scravo, stony-Kalsted-Cabbart, 15 to 45 percent slopes

Map Unit Setting

Elevation: 6,000 to 6,700 feet

Mean annual precipitation: 12 to 14 inches

Frost-free period: 70 to 90 days

Component Description

Scravo and similar soils

Composition: 35 percent

Geomorphic description: Escarpment

Slope: 15 to 45 percent

Elevation: 6,000 to 6,700 feet

Effective annual precipitation: 12 to 14 inches

Frost-free period: 70 to 90 days

Surface layer texture: Gravelly sandy loam

Rock fragments on the soil surface: 0.01 to 0.10 percent stones

Depth to restrictive feature: None noted

Drainage class: Well drained

Parent material: Sandy and gravelly alluvium

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 2.2 inches

Kalsted and similar soils

Composition: 30 percent

Geomorphic description: Escarpment

Slope: 15 to 45 percent

Elevation: 6,000 to 6,700 feet

Effective annual precipitation: 12 to 14 inches

Frost-free period: 70 to 90 days

Surface layer texture: Gravelly sandy loam

Depth to restrictive feature: None noted

Drainage class: Well drained

Parent material: Alluvium

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 6.9 inches

Cabbart and similar soils

Composition: 15 percent

Geomorphic description: Escarpment

Slope: 15 to 45 percent

Elevation: 6,000 to 6,700 feet

Effective annual precipitation: 12 to 14 inches

Frost-free period: 70 to 90 days

Surface layer texture: Cobbly loam

Depth to restrictive feature: Bedrock (paralithic): 10 to 20 inches

Drainage class: Well drained

Parent material: Residuum weathered from calcareous siltstone

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 2.7 inches

Additional Components

Rock outcrop: 10 percent

Bronec and similar soils: 8 percent

Trimad and similar soils: 2 percent

27D—Barbarela-Nieman-Oro Fino complex, 2 to 15 percent slopes

Map Unit Setting

Elevation: 6,800 to 7,800 feet

Mean annual precipitation: 15 to 19 inches

Frost-free period: 30 to 70 days

Component Description

Barbarela and similar soils

Composition: 40 percent

Geomorphic description: Hill

Slope: 2 to 15 percent

Elevation: 6,800 to 7,800 feet

Effective annual precipitation: 15 to 19 inches

Frost-free period: 30 to 70 days

Surface layer texture: Sandy loam

Depth to restrictive feature:

- *Bedrock (paralithic):* 20 to 40 inches
- *Bedrock (lithic):* 25 to 60 inches

Drainage class: Well drained

Parent material: Colluvium or residuum derived from gneiss or schist

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 4.9 inches

Nieman and similar soils

Composition: 20 percent

Geomorphic description: Structural bench

Slope: 2 to 15 percent

Elevation: 6,800 to 7,800 feet

Effective annual precipitation: 15 to 19 inches

Frost-free period: 30 to 70 days

Surface layer texture: Cobbly loam

Depth to restrictive feature: Bedrock (lithic): 10 to 20 inches

Drainage class: Well drained

Parent material: Alluvium over schist and/or gneiss

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 1.2 inches

Oro Fino and similar soils

Composition: 15 percent

Geomorphic description: Structural bench

Slope: 2 to 15 percent

Elevation: 6,800 to 7,800 feet

Effective annual precipitation: 15 to 19 inches

Frost-free period: 30 to 70 days

Surface layer texture: Loam

Depth to restrictive feature: None noted

Drainage class: Well drained

Parent material: Colluvium derived from gneiss or schist

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 6.3 inches

Additional Components

Nieman, very stony and similar soils: 5 percent

Rock outcrop: 5 percent

Poin and similar soils: 4 percent

Surdal and similar soils: 4 percent

Branham and similar soils: 3 percent

Finn and similar soils: 2 percent

Libeg and similar soils: 2 percent

27E—Bronec very cobbly loam, 8 to 35 percent slopes

Map Unit Setting

Elevation: 5,000 to 6,400 feet

Mean annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Component Description

Bronec and similar soils

Composition: 85 percent

Geomorphic description: Hill

Slope: 8 to 35 percent

Elevation: 5,000 to 6,400 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Very cobbly loam

Depth to restrictive feature: None noted

Drainage class: Well drained

Parent material: Calcareous alluvium

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 5.9 inches

Additional Components

Geohrock and similar soils: 3 percent

Kalsted and similar soils: 3 percent

Amesha and similar soils: 2 percent

Bronec, very stony and similar soils: 2 percent

Bronec, stony and similar soils: 2 percent

Kalsted and similar soils: 2 percent

Scravo and similar soils: 1 percent

28C—Beavwan gravelly sandy loam, 2 to 8 percent slopes**Map Unit Setting**

Elevation: 5,800 to 6,300 feet

Mean annual precipitation: 12 to 14 inches

Frost-free period: 70 to 90 days

Component Description**Beavwan and similar soils**

Composition: 75 percent

Geomorphic description: Alluvial fan

Slope: 2 to 8 percent

Elevation: 5,800 to 6,300 feet

Effective annual precipitation: 12 to 14 inches

Frost-free period: 70 to 90 days

Surface layer texture: Gravelly sandy loam

Depth to restrictive feature: None noted

Drainage class: Well drained

Parent material: Alluvium

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 4.1 inches

Additional Components

Beavwan, cobbly and similar soils: 5 percent

Sappington and similar soils: 5 percent

Scravo and similar soils: 5 percent

Varney and similar soils: 5 percent

Nippt and similar soils: 3 percent

Geohrock and similar soils: 2 percent

**29E—Poin, flaggy-Barbarela-Rock outcrop complex,
8 to 25 percent slopes****Map Unit Setting**

Elevation: 6,200 to 7,200 feet

Mean annual precipitation: 15 to 19 inches

Frost-free period: 30 to 70 days

Component Description**Poin and similar soils**

Composition: 45 percent

Geomorphic description: Hillside

Slope: 8 to 25 percent

Elevation: 6,200 to 7,200 feet

Effective annual precipitation: 15 to 19 inches

Frost-free period: 30 to 70 days

Surface layer texture: Channery sandy loam

Rock fragments on the soil surface: 0.01 to 0.10 percent stones

Depth to restrictive feature: Bedrock (lithic): 10 to 20 inches

Drainage class: Well drained

Parent material: Colluvium over residuum weathered from gneiss and/or residuum weathered from schist

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 1.6 inches

Barbarela and similar soils

Composition: 30 percent

Geomorphic description: Hillside

Slope: 8 to 25 percent

Elevation: 6,200 to 7,200 feet

Effective annual precipitation: 15 to 19 inches

Frost-free period: 30 to 70 days

Surface layer texture: Sandy loam

Depth to restrictive feature:

- *Bedrock (paralithic):* 20 to 40 inches
- *Bedrock (lithic):* 25 to 60 inches

Drainage class: Well drained

Parent material: Colluvium over residuum weathered from gneiss and/or residuum weathered from schist

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 4.9 inches

Rock outcrop

Composition: 15 percent

Additional Components

Nieman and similar soils: 7 percent

Tibkey and similar soils: 3 percent

29F—Brocko-Crago complex, cool, 8 to 45 percent slopes

Map Unit Setting

Elevation: 4,300 to 6,500 feet

Mean annual precipitation: 10 to 14 inches

Frost-free period: 90 to 110 days

Component Description

Brocko and similar soils

Composition: 60 percent

Geomorphic description: Escarpment and stream terrace

Slope: 8 to 45 percent

Elevation: 4,300 to 6,500 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 110 days

Surface layer texture: Silt loam

Depth to restrictive feature: None noted

Drainage class: Well drained

Parent material: Coarse-silty alluvium and/or eolian deposits

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 10.9 inches

Crago and similar soils*Composition:* 30 percent*Geomorphic description:* Escarpment and stream terrace*Slope:* 8 to 45 percent*Elevation:* 4,300 to 6,500 feet*Effective annual precipitation:* 10 to 14 inches*Frost-free period:* 90 to 110 days*Surface layer texture:* Gravelly loam*Depth to restrictive feature:* None noted*Drainage class:* Well drained*Parent material:* Gravelly alluvium derived from limestone*Native plant cover type:* Rangeland*Flooding:* None*Available water capacity:* Mainly 3.0 inches**Additional Components**

Scravo and similar soils: 4 percent

Varney and similar soils: 4 percent

Wetsand and similar soils: 2 percent

30B—Thess loam, 0 to 4 percent slopes**Map Unit Setting***Elevation:* 5,000 to 6,200 feet*Mean annual precipitation:* 10 to 14 inches*Frost-free period:* 90 to 105 days**Component Description****Thess and similar soils***Composition:* 85 percent*Geomorphic description:* Alluvial fan and terrace*Slope:* 0 to 4 percent*Elevation:* 5,000 to 6,200 feet*Effective annual precipitation:* 10 to 14 inches*Frost-free period:* 90 to 105 days*Surface layer texture:* Loam*Depth to restrictive feature:* None noted*Drainage class:* Well drained*Parent material:* Calcareous alluvium*Native plant cover type:* Rangeland*Flooding:* None*Available water capacity:* Mainly 6.3 inches**Additional Components**

Thessvo and similar soils: 5 percent

Amesha and similar soils: 4 percent

Scravo and similar soils: 3 percent

Crago and similar soils: 1 percent

Dillon and similar soils: 1 percent

Scravo, stony and similar soils: 1 percent

30E—Nieman, very stony-Rock outcrop complex, 8 to 60 percent slopes

Map Unit Setting

Elevation: 6,200 to 7,600 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 30 to 70 days

Component Description

Nieman and similar soils

Composition: 40 percent
Geomorphic description: Shoulder on hill and ridge
Slope: 8 to 60 percent
Elevation: 6,200 to 7,600 feet
Effective annual precipitation: 15 to 19 inches
Frost-free period: 30 to 70 days
Surface layer texture: Very cobbly loam
Rock fragments on the soil surface: 0.10 to 3.00 percent stones
Depth to restrictive feature: Bedrock (lithic): 10 to 20 inches
Drainage class: Well drained
Parent material: Residuum over gneiss and/or schist
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.0 inches

Rock outcrop

Composition: 30 percent

Additional Components

Barbarela and similar soils: 10 percent
Poin and similar soils: 10 percent
Oro Fino and similar soils: 8 percent
Tibkey and similar soils: 2 percent

31A—Ashbough silt loam, 0 to 2 percent slopes

Map Unit Setting

Elevation: 5,800 to 6,500 feet
Mean annual precipitation: 12 to 14 inches
Frost-free period: 70 to 90 days

Component Description

Ashbough and similar soils

Composition: 85 percent
Geomorphic description: Flood plain and stream terrace
Slope: 0 to 2 percent
Elevation: 5,800 to 6,500 feet
Effective annual precipitation: 12 to 14 inches
Frost-free period: 70 to 90 days
Surface layer texture: Silt loam
Depth to restrictive feature: None noted

Drainage class: Moderately well drained
Parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare
Water table: Present
Available water capacity: Mainly 9.9 inches

Additional Components

Faith and similar soils: 5 percent
Yamacall and similar soils: 5 percent
Madbeaver and similar soils: 3 percent
Beavrock and similar soils: 1 percent
Trudau and similar soils: 1 percent

32B—Yamacall loam, 0 to 4 percent slopes

Map Unit Setting

Elevation: 4,800 to 5,600 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days

Component Description

Yamacall and similar soils

Composition: 80 percent
Geomorphic description: Alluvial fan
Slope: 0 to 4 percent
Elevation: 4,800 to 5,600 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Loam
Depth to restrictive feature: None noted
Drainage class: Well drained
Parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.4 inches

Additional Components

Amesha and similar soils: 5 percent
Brockway and similar soils: 5 percent
Trudau and similar soils: 3 percent
Yamacall and similar soils: 3 percent
Sappington and similar soils: 2 percent
Bronec and similar soils: 1 percent
Thess and similar soils: 1 percent

32E—Fourmile complex, 8 to 25 percent slopes

Map Unit Setting

Elevation: 6,100 to 7,200 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 30 to 70 days

Component Description

Fourmile and similar soils

Composition: 65 percent
Geomorphic description: Alluvial fan and hillside
Slope: 8 to 15 percent
Elevation: 6,100 to 7,200 feet
Effective annual precipitation: 15 to 19 inches
Frost-free period: 30 to 70 days
Surface layer texture: Gravelly loam
Depth to restrictive feature: None noted
Drainage class: Well drained
Parent material: Alluvium and/or colluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.1 inches

Fourmile, extremely bouldery and similar soils

Composition: 15 percent
Geomorphic description: Alluvial fan and hillside
Slope: 8 to 25 percent
Elevation: 6,100 to 7,200 feet
Effective annual precipitation: 15 to 19 inches
Frost-free period: 30 to 70 days
Surface layer texture: Very cobbly loam
Rock fragments on the soil surface: 3 to 15 percent boulders
Depth to restrictive feature: None noted
Drainage class: Well drained
Parent material: Alluvium and/or colluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.4 inches

Additional Components

Tiban and similar soils: 10 percent
Philipsburg and similar soils: 8 percent
Finn and similar soils: 2 percent

33E—Shadow complex, 15 to 70 percent slopes

Map Unit Setting

Elevation: 6,300 to 8,100 feet
Mean annual precipitation: 20 to 24 inches
Frost-free period: 30 to 70 days

Component Description

Shadow, very stony and similar soils

Composition: 35 percent

Geomorphic description: Mountain slope

Slope: 15 to 65 percent

Elevation: 6,300 to 8,100 feet

Effective annual precipitation: 20 to 24 inches

Frost-free period: 30 to 70 days

Surface layer texture: Very channery loam

Rock fragments on the soil surface: 0.10 to 3.00 percent stones

Depth to restrictive feature: None noted

Drainage class: Somewhat excessively drained

Parent material: Colluvium

Native plant cover type: Forestland

Flooding: None

Available water capacity: Mainly 3.4 inches

Shadow, stony and similar soils

Composition: 20 percent

Geomorphic description: Mountain slope

Slope: 15 to 65 percent

Elevation: 6,300 to 8,100 feet

Effective annual precipitation: 20 to 24 inches

Frost-free period: 30 to 70 days

Surface layer texture: Channery loam

Rock fragments on the soil surface: 0.01 to 0.10 percent stones

Depth to restrictive feature: None noted

Drainage class: Somewhat excessively drained

Parent material: Colluvium

Native plant cover type: Forestland

Flooding: None

Available water capacity: Mainly 3.6 inches

Shadow and similar soils

Composition: 15 percent

Geomorphic description: Mountain slope

Slope: 15 to 65 percent

Elevation: 6,300 to 8,100 feet

Effective annual precipitation: 20 to 24 inches

Frost-free period: 30 to 70 days

Surface layer texture: Channery loam

Depth to restrictive feature: None noted

Drainage class: Somewhat excessively drained

Parent material: Colluvium

Native plant cover type: Forestland

Flooding: None

Available water capacity: Mainly 3.6 inches

Additional Components

Rock outcrop: 10 percent

Worock and similar soils: 10 percent

Poin and similar soils: 8 percent

Tibkey and similar soils: 2 percent

34C—Nippt-Scravo gravelly loams, 1 to 4 percent slopes

Map Unit Setting

Elevation: 5,800 to 6,400 feet

Mean annual precipitation: 12 to 14 inches

Frost-free period: 70 to 90 days

Component Description

Nippt and similar soils

Composition: 40 percent

Geomorphic description: Alluvial fan

Slope: 1 to 4 percent

Elevation: 6,100 to 6,400 feet

Effective annual precipitation: 12 to 14 inches

Frost-free period: 70 to 90 days

Surface layer texture: Gravelly loam

Depth to restrictive feature: None noted

Drainage class: Well drained

Parent material: Alluvium

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 2.7 inches

Scravo and similar soils

Composition: 40 percent

Geomorphic description: Alluvial fan

Slope: 1 to 4 percent

Elevation: 6,100 to 6,400 feet

Effective annual precipitation: 12 to 14 inches

Frost-free period: 70 to 90 days

Surface layer texture: Gravelly sandy loam

Depth to restrictive feature: None noted

Drainage class: Well drained

Parent material: Alluvium

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 2.2 inches

Additional Components

Thess and similar soils: 10 percent

Thessvo and similar soils: 3 percent

Nippt, very cobbly loam and similar soils: 2 percent

Rivra and similar soils: 2 percent

Scravo, very cobbly sandy loam and similar soils: 2 percent

Amesha and similar soils: 1 percent

35B—Kalsted sandy loam, 0 to 4 percent slopes

Map Unit Setting

Elevation: 4,800 to 6,100 feet

Mean annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Component Description

Kalsted and similar soils

Composition: 80 percent
Geomorphic description: Alluvial fan
Slope: 0 to 4 percent
Elevation: 4,800 to 6,100 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Sandy loam
Depth to restrictive feature: None noted
Drainage class: Well drained
Parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 6.9 inches

Additional Components

Amesha and similar soils: 5 percent
Bronec and similar soils: 3 percent
Kalsted and similar soils: 3 percent
Sappington and similar soils: 3 percent
Musselshell and similar soils: 2 percent
Scravo and similar soils: 2 percent
Thess and similar soils: 2 percent

35C—Kalsted sandy loam, 4 to 8 percent slopes

Map Unit Setting

Elevation: 4,800 to 6,100 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days

Component Description

Kalsted and similar soils

Composition: 80 percent
Geomorphic description: Alluvial fan
Slope: 4 to 8 percent
Elevation: 4,800 to 6,100 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Sandy loam
Depth to restrictive feature: None noted
Drainage class: Well drained
Parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 6.9 inches

Additional Components

Amesha and similar soils: 5 percent
Sappington and similar soils: 4 percent
Bronec and similar soils: 3 percent

Kalsted, greater slopes and similar soils: 3 percent
Thess and similar soils: 2 percent
Trudau and similar soils: 2 percent
Scravo and similar soils: 1 percent

36B—Amesha loam, 0 to 4 percent slopes

Map Unit Setting

Elevation: 5,000 to 6,200 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days

Component Description

Amesha and similar soils

Composition: 80 percent
Geomorphic description: Alluvial fan
Slope: 0 to 4 percent
Elevation: 5,000 to 6,200 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Loam
Depth to restrictive feature: None noted
Drainage class: Well drained
Parent material: Calcareous alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.3 inches

Additional Components

Kalsted and similar soils: 5 percent
Amesha, greater slopes and similar soils: 3 percent
Bronec and similar soils: 3 percent
Sappington and similar soils: 3 percent
Trudau and similar soils: 3 percent
Thess and similar soils: 2 percent
Ashbough and similar soils: 1 percent

36C—Amesha loam, 4 to 8 percent slopes

Map Unit Setting

Elevation: 5,000 to 6,200 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days

Component Description

Amesha and similar soils

Composition: 80 percent
Geomorphic description: Alluvial fan
Slope: 4 to 8 percent
Elevation: 5,000 to 6,200 feet
Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days
Surface layer texture: Loam
Depth to restrictive feature: None noted
Drainage class: Well drained
Parent material: Calcareous alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.3 inches

Additional Components

Kalsted and similar soils: 8 percent
 Sappington and similar soils: 4 percent
 Yamacall and similar soils: 3 percent
 Brocko and similar soils: 2 percent
 Bronec and similar soils: 1 percent
 Scravo and similar soils: 1 percent
 Trudau and similar soils: 1 percent

36E—Kounter-Amesha-Rock outcrop complex, 8 to 35 percent slopes

Map Unit Setting

Elevation: 5,700 to 6,500 feet
Mean annual precipitation: 10 to 17 inches
Frost-free period: 50 to 90 days

Component Description

Kounter and similar soils

Composition: 40 percent
Geomorphic description: Strike ridge and hill
Slope: 8 to 35 percent
Elevation: 5,700 to 6,500 feet
Effective annual precipitation: 10 to 17 inches
Frost-free period: 70 to 90 days
Surface layer texture: Gravelly sandy loam
Depth to restrictive feature:

- *Bedrock (paralithic):* 10 to 18 inches
- *Bedrock (lithic):* 12 to 20 inches

Drainage class: Somewhat excessively drained
Parent material: Gravelly residuum over schist and/or gneiss
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 0.8 inches

Amesha and similar soils

Composition: 20 percent
Geomorphic description: Alluvial fan
Slope: 8 to 15 percent
Elevation: 5,700 to 6,500 feet
Effective annual precipitation: 10 to 17 inches
Frost-free period: 70 to 90 days
Surface layer texture: Loam

Depth to restrictive feature: None noted
Drainage class: Well drained
Parent material: Calcareous alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.3 inches

Rock outcrop

Composition: 15 percent

Additional Components

Sappington and similar soils: 10 percent
Kalsted and similar soils: 5 percent
Trudau and similar soils: 5 percent
Kounter, stony and similar soils: 4 percent
Tibkey and similar soils: 1 percent

37B—Brockway silt loam, 0 to 4 percent slopes**Map Unit Setting**

Elevation: 5,000 to 5,400 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days

Component Description**Brockway and similar soils**

Composition: 80 percent
Geomorphic description: Alluvial fan
Slope: 0 to 4 percent
Elevation: 5,000 to 5,400 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Silt loam
Depth to restrictive feature: None noted
Drainage class: Well drained
Parent material: Calcareous alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.9 inches

Additional Components

Yamacall and similar soils: 7 percent
Brocko and similar soils: 5 percent
Brockway, silty clay loam and similar soils: 4 percent
Amesha and similar soils: 3 percent
Madbeaver and similar soils: 1 percent

37C—Tiban-Maciver gravelly loams, 2 to 8 percent slopes**Map Unit Setting**

Elevation: 6,700 to 7,600 feet

Mean annual precipitation: 15 to 19 inches

Frost-free period: 30 to 70 days

Component Description**Tiban and similar soils**

Composition: 45 percent

Geomorphic description: Fan terrace

Slope: 2 to 8 percent

Elevation: 6,700 to 7,600 feet

Effective annual precipitation: 15 to 19 inches

Frost-free period: 30 to 70 days

Surface layer texture: Gravelly loam

Depth to restrictive feature: None noted

Drainage class: Well drained

Parent material: Alluvium

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 5.6 inches

Maciver and similar soils

Composition: 40 percent

Geomorphic description: Fan terrace

Slope: 2 to 8 percent

Elevation: 6,700 to 7,600 feet

Effective annual precipitation: 15 to 19 inches

Frost-free period: 30 to 70 days

Surface layer texture: Gravelly loam

Depth to restrictive feature: None noted

Drainage class: Well drained

Parent material: Alluvium

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 5.3 inches

Additional Components

Tiban, greater slopes and similar soils: 8 percent

Philipsburg and similar soils: 5 percent

Adel and similar soils: 2 percent

37E—Crago-Scravo complex, 15 to 45 percent slopes**Map Unit Setting**

Elevation: 4,500 to 5,500 feet

Mean annual precipitation: 10 to 14 inches

Frost-free period: 90 to 110 days

Component Description

Crago and similar soils

Composition: 50 percent

Geomorphic description: Escarpment and stream terrace

Slope: 15 to 45 percent

Elevation: 4,500 to 5,500 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 110 days

Surface layer texture: Very gravelly loam

Depth to restrictive feature: None noted

Drainage class: Well drained

Parent material: Gravelly alluvium derived from limestone

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 3.4 inches

Scravo and similar soils

Composition: 40 percent

Geomorphic description: Escarpment and stream terrace

Slope: 15 to 45 percent

Elevation: 4,500 to 5,500 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 110 days

Surface layer texture: Cobbly sandy loam

Depth to restrictive feature: None noted

Drainage class: Well drained

Parent material: Sandy and gravelly alluvium

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 2.4 inches

Additional Components

Crago, stony and similar soils: 3 percent

Musselshell and similar soils: 3 percent

Conglomerate outcrop and similar soils: 2 percent

Sandstone outcrop and similar soils: 2 percent

38D—Philipsburg loam, 2 to 15 percent slopes

Map Unit Setting

Elevation: 6,100 to 8,000 feet

Mean annual precipitation: 15 to 19 inches

Frost-free period: 30 to 70 days

Component Description

Philipsburg and similar soils

Composition: 80 percent

Geomorphic description: Fan terrace

Slope: 2 to 15 percent

Elevation: 6,100 to 8,000 feet

Effective annual precipitation: 15 to 19 inches

Frost-free period: 30 to 70 days

Surface layer texture: Loam
Depth to restrictive feature: None noted
Drainage class: Well drained
Parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 8.8 inches

Additional Components

Adel and similar soils: 5 percent
Bridger and similar soils: 5 percent
Tiban and similar soils: 5 percent
Maciver and similar soils: 4 percent
Foolhen and similar soils: 1 percent

39C—Trimad gravelly loam, 2 to 8 percent slopes

Map Unit Setting

Elevation: 6,400 to 6,800 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 50 to 90 days

Component Description

Trimad and similar soils

Composition: 85 percent
Geomorphic description: Fan terrace
Slope: 2 to 8 percent
Elevation: 6,400 to 6,800 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 70 to 90 days
Surface layer texture: Gravelly loam
Depth to restrictive feature: None noted
Drainage class: Well drained
Parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.1 inches

Additional Components

Kalsted and similar soils: 5 percent
Bronec and similar soils: 3 percent
Philipsburg and similar soils: 2 percent
Tiban and similar soils: 2 percent
Trimad, greater slopes and similar soils: 2 percent
Sappington and similar soils: 1 percent

40E—Philipsburg-Tiban-Adel complex, 15 to 45 percent slopes

Map Unit Setting

Elevation: 6,400 to 8,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 30 to 70 days

Component Description

Philipsburg and similar soils

Composition: 45 percent
Geomorphic description: Hillside
Slope: 15 to 45 percent
Elevation: 6,400 to 8,000 feet
Effective annual precipitation: 15 to 19 inches
Frost-free period: 30 to 70 days
Surface layer texture: Gravelly loam
Depth to restrictive feature: None noted
Drainage class: Well drained
Parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 8.8 inches

Tiban and similar soils

Composition: 25 percent
Geomorphic description: Hillside
Slope: 15 to 45 percent
Elevation: 6,400 to 8,000 feet
Effective annual precipitation: 15 to 19 inches
Frost-free period: 30 to 70 days
Surface layer texture: Very cobbly loam
Depth to restrictive feature: None noted
Drainage class: Well drained
Parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.5 inches

Adel and similar soils

Composition: 15 percent
Geomorphic description: Footslope on hill and swale
Slope: 15 to 45 percent
Elevation: 6,400 to 8,000 feet
Effective annual precipitation: 15 to 19 inches
Frost-free period: 30 to 70 days
Surface layer texture: Loam
Depth to restrictive feature: None noted
Drainage class: Well drained
Parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.6 inches

Additional Components

Tiban, greater slopes and similar soils: 4 percent
Bridger and similar soils: 3 percent
Maciver and similar soils: 3 percent
Rock outcrop: 2 percent
Tiban, very cobbly loam and similar soils: 2 percent
Foolhen and similar soils: 1 percent

41E—Bronec, Amesha, and Riverrun, channeled soils, 0 to 35 percent slopes

Map Unit Setting

Elevation: 5,000 to 6,000 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days

Component Description

Bronec and similar soils

Composition: 35 percent
Geomorphic description: Alluvial fan and hillside
Slope: 1 to 35 percent
Elevation: 5,000 to 6,000 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Very gravelly loam
Depth to restrictive feature: None noted
Drainage class: Well drained
Parent material: Sandy and gravelly calcareous tertiary valley fill alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.7 inches

Amesha and similar soils

Composition: 30 percent
Geomorphic description: Footslope on hill and toeslope on hill
Slope: 1 to 35 percent
Elevation: 5,000 to 6,000 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Gravelly loam
Depth to restrictive feature: None noted
Drainage class: Well drained
Parent material: Calcareous coarse-loamy tertiary valley fill alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 8.3 inches

Riverrun and similar soils

Composition: 20 percent
Geomorphic description: Drainageway, flood plain, and flood-plain step
Slope: 0 to 2 percent
Elevation: 5,000 to 6,000 feet

Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Gravelly sandy loam
Depth to restrictive feature: None noted
Drainage class: Moderately well drained
Parent material: Sandy and gravelly recent alluvium from mixed igneous, sedimentary, and metamorphic rocks
Native plant cover type: Rangeland
Flooding: Occasional
Water table: Present
Available water capacity: Mainly 2.1 inches

Additional Components

Bronec, very stony and similar soils: 4 percent
 Amesha, cobbly and similar soils: 3 percent
 Geohrock, stony and similar soils: 3 percent
 Sappington and similar soils: 3 percent
 Wetsand and similar soils: 2 percent

42E—Spudbar, extremely bouldery-Rubble land-Rock outcrop complex, 15 to 45 percent slopes

Map Unit Setting

Elevation: 6,400 to 6,700 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 70 to 90 days

Component Description

Spudbar and similar soils

Composition: 60 percent
Geomorphic description: Escarpment
Slope: 15 to 45 percent
Elevation: 6,400 to 6,700 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 70 to 90 days
Surface layer texture: Very cobbly loam
Rock fragments on the soil surface: 3 to 15 percent boulders
Depth to restrictive feature: Bedrock (lithic): 20 to 40 inches
Drainage class: Well drained
Parent material: Gravelly colluvium over residuum weathered from argillite
Native plant cover type: Rangeland
Available water capacity: Mainly 2.1 inches

Rubble land

Composition: 20 percent

Rock outcrop

Composition: 15 percent

Additional Components

Rivra and similar soils: 5 percent

44E—Tiban-Philipsburg-Roxal complex, 15 to 45 percent slopes

Map Unit Setting

Elevation: 6,400 to 8,000 feet

Mean annual precipitation: 15 to 19 inches

Frost-free period: 30 to 70 days

Component Description

Tiban and similar soils

Composition: 45 percent

Geomorphic description: Escarpment and hillside

Slope: 15 to 45 percent

Elevation: 6,400 to 8,000 feet

Effective annual precipitation: 15 to 19 inches

Frost-free period: 30 to 70 days

Surface layer texture: Very cobbly loam

Depth to restrictive feature: None noted

Drainage class: Well drained

Parent material: Gravelly alluvium

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 5.6 inches

Philipsburg and similar soils

Composition: 20 percent

Geomorphic description: Hillside

Slope: 15 to 35 percent

Elevation: 6,400 to 8,000 feet

Effective annual precipitation: 15 to 19 inches

Frost-free period: 30 to 70 days

Surface layer texture: Gravelly loam

Depth to restrictive feature: None noted

Drainage class: Well drained

Parent material: Alluvium

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 8.8 inches

Roxal and similar soils

Composition: 10 percent

Geomorphic description: Escarpment and hillside

Slope: 15 to 45 percent

Elevation: 6,400 to 8,000 feet

Effective annual precipitation: 15 to 19 inches

Frost-free period: 30 to 70 days

Surface layer texture: Loam

Depth to restrictive feature: Bedrock (paralithic): 10 to 20 inches

Drainage class: Well drained

Parent material: Residium weathered from sandstone and siltstone

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 3.0 inches

Additional Components

Rock outcrop: 6 percent
Maciver and similar soils: 5 percent
Tiban and similar soils: 5 percent
Adel and similar soils: 3 percent
Bridger and similar soils: 3 percent
Philipsburg, lesser slopes and similar soils: 3 percent

45E—Maciver gravelly loam, 1 to 4 percent slopes

Map Unit Setting

Elevation: 6,300 to 7,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 30 to 70 days

Component Description

Maciver and similar soils

Composition: 80 percent
Geomorphic description: Alluvial fan
Slope: 1 to 4 percent
Elevation: 6,300 to 7,000 feet
Effective annual precipitation: 15 to 19 inches
Frost-free period: 30 to 70 days
Surface layer texture: Gravelly loam
Depth to restrictive feature: None noted
Drainage class: Well drained
Parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.3 inches

Additional Components

Tiban and similar soils: 8 percent
Philipsburg and similar soils: 5 percent
Riverwash: 5 percent
Foolhen and similar soils: 2 percent

47D—Spudbar complex, 2 to 15 percent slopes

Map Unit Setting

Elevation: 6,300 to 6,800 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 70 to 90 days

Component Description

Spudbar, very stony and similar soils

Composition: 50 percent
Geomorphic description: Hillslope
Slope: 2 to 15 percent
Elevation: 6,300 to 6,800 feet
Effective annual precipitation: 10 to 14 inches

Frost-free period: 70 to 90 days
Surface layer texture: Gravelly loam
Rock fragments on the soil surface: 0.10 to 3.00 percent stones
Depth to restrictive feature: Bedrock (lithic): 20 to 40 inches
Drainage class: Well drained
Parent material: Colluvium over residuum weathered from basalt
Native plant cover type: Rangeland
Available water capacity: Mainly 2.3 inches

Spudbar and similar soils

Composition: 20 percent
Geomorphic description: Hillslope
Slope: 2 to 15 percent
Elevation: 6,300 to 6,800 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 70 to 90 days
Surface layer texture: Gravelly loam
Depth to restrictive feature: Bedrock (lithic): 20 to 40 inches
Drainage class: Well drained
Parent material: Colluvium over residuum weathered from basalt
Native plant cover type: Rangeland
Available water capacity: Mainly 2.3 inches

Spudbar, extremely bouldery and similar soils

Composition: 15 percent
Geomorphic description: Hillslope
Slope: 2 to 15 percent
Elevation: 6,300 to 6,800 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 70 to 90 days
Surface layer texture: Very cobbly loam
Rock fragments on the soil surface: 3 to 15 percent boulders
Depth to restrictive feature: Bedrock (lithic): 20 to 40 inches
Drainage class: Well drained
Parent material: Colluvium over residuum weathered from basalt
Native plant cover type: Rangeland
Available water capacity: Mainly 2.1 inches

Additional Components

Rock outcrop: 5 percent
Bronc and similar soils: 4 percent
Rencot and similar soils: 3 percent
Twinadams and similar soils: 3 percent

**49E—Geohrock very cobbly loam, very stony,
15 to 35 percent slopes****Map Unit Setting**

Elevation: 5,000 to 6,200 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days

Component Description

Geohrock and similar soils

Composition: 90 percent
Geomorphic description: Escarpment and north-facing slopes on hill
Slope: 15 to 35 percent
Elevation: 5,000 to 6,200 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Very cobbly sandy loam
Rock fragments on the soil surface: 0.10 to 3.00 percent stones
Depth to restrictive feature: None noted
Drainage class: Well drained
Parent material: Alluvium and/or outwash
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.7 inches

Additional Components

Bronec and similar soils: 3 percent
 Geohrock, greater slopes and similar soils: 2 percent
 Varney and similar soils: 2 percent
 Varney and similar soils: 2 percent
 Geohrock, stony and similar soils: 1 percent

53E—Hanson-Rock outcrop complex, 25 to 45 percent slopes

Map Unit Setting

Elevation: 5,000 to 7,500 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 50 to 90 days

Component Description

Hanson and similar soils

Composition: 50 percent
Geomorphic description: Shoulder on hill and footslope on hill
Slope: 25 to 45 percent
Elevation: 5,000 to 7,500 feet
Effective annual precipitation: 15 to 19 inches
Frost-free period: 50 to 90 days
Surface layer texture: Channery loam
Depth to restrictive feature: None noted
Drainage class: Well drained
Parent material: Gravelly colluvium derived from limestone
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.0 inches

Rock outcrop

Composition: 30 percent
Geomorphic description: Backslope on hill and summit on hill

Additional Components

Adel and similar soils: 7 percent
Tiban and similar soils: 7 percent
Hanson, stony and similar soils: 6 percent

58A—Havre loam, cool, 0 to 2 percent slopes**Map Unit Setting**

Elevation: 4,200 to 6,000 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 90 to 110 days

Component Description**Havre and similar soils**

Composition: 90 percent
Geomorphic description: Flood plain and stream terrace
Slope: 0 to 2 percent
Elevation: 4,200 to 6,000 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Loam
Depth to restrictive feature: None noted
Drainage class: Well drained
Parent material: Fine-loamy alluvium
Native plant cover type: Rangeland
Flooding: Rare
Available water capacity: Mainly 8.6 inches

Additional Components

Glendive and similar soils: 5 percent
Ryell and similar soils: 5 percent

60A—Riverrun-Rivra complex, 0 to 2 percent slopes**Map Unit Setting**

Elevation: 5,170 to 5,300 feet
Mean annual precipitation: 10 to 12 inches
Frost-free period: 70 to 90 days

Component Description**Riverrun and similar soils**

Composition: 50 percent
Geomorphic description: Flood plain
Slope: 0 to 1 percent
Elevation: 5,170 to 5,300 feet
Effective annual precipitation: 10 to 12 inches
Frost-free period: 70 to 90 days
Surface layer texture: Fine sandy loam
Depth to restrictive feature: None noted
Drainage class: Somewhat poorly drained
Parent material: Sandy alluvium

Native plant cover type: Riparian
Flooding: None
Water table: Present
Available water capacity: Mainly 3.6 inches

Rivra and similar soils

Composition: 35 percent
Geomorphic description: Stream terrace
Slope: 0 to 2 percent
Elevation: 5,170 to 5,300 feet
Effective annual precipitation: 10 to 12 inches
Frost-free period: 70 to 90 days
Surface layer texture: Gravelly sandy loam
Depth to restrictive feature: None noted
Drainage class: Well drained
Parent material: Sandy alluvium
Native plant cover type: Riparian
Flooding: None
Available water capacity: Mainly 3.1 inches

Additional Components

Meadowcreek and similar soils: 8 percent
 Work and similar soils: 4 percent
 Bonebasin and similar soils: 3 percent

60C—Kalsted loamy sand, 2 to 8 percent slopes

Map Unit Setting

Elevation: 5,000 to 5,800 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 90 to 115 days

Component Description

Kalsted and similar soils

Composition: 90 percent
Geomorphic description: Stream terrace
Slope: 2 to 8 percent
Elevation: 5,000 to 5,800 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 110 days
Surface layer texture: Loamy sand
Depth to restrictive feature: None noted
Drainage class: Well drained
Parent material: Coarse-loamy alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.7 inches

Additional Components

Crago and similar soils: 5 percent
 Musselshell and similar soils: 5 percent

61A—Kalsted sandy loam, 0 to 2 percent slopes**Map Unit Setting**

Elevation: 4,500 to 6,500 feet

Mean annual precipitation: 10 to 14 inches

Frost-free period: 90 to 110 days

Component Description**Kalsted and similar soils**

Composition: 90 percent

Geomorphic description: Stream terrace

Slope: 0 to 2 percent

Elevation: 4,500 to 6,500 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 110 days

Surface layer texture: Sandy loam

Depth to restrictive feature: None noted

Drainage class: Well drained

Parent material: Coarse-loamy alluvium

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 6.2 inches

Additional Components

Crago and similar soils: 10 percent

62C—Kalsted sandy loam, 2 to 8 percent slopes**Map Unit Setting**

Elevation: 4,500 to 6,500 feet

Mean annual precipitation: 10 to 14 inches

Frost-free period: 90 to 110 days

Component Description**Kalsted and similar soils**

Composition: 90 percent

Geomorphic description: Hill and stream terrace

Slope: 2 to 8 percent

Elevation: 4,500 to 6,500 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 110 days

Surface layer texture: Sandy loam

Depth to restrictive feature: None noted

Drainage class: Well drained

Parent material: Coarse-loamy alluvium

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 6.2 inches

Additional Components

Crago and similar soils: 5 percent

Scravo and similar soils: 5 percent

63D—Kalsted sandy loam, 8 to 15 percent slopes

Map Unit Setting

Elevation: 4,500 to 6,500 feet

Mean annual precipitation: 10 to 14 inches

Frost-free period: 90 to 110 days

Component Description

Kalsted and similar soils

Composition: 90 percent

Geomorphic description: Foothlope on hill and backslope on hill

Slope: 8 to 15 percent

Elevation: 4,500 to 6,500 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 110 days

Surface layer texture: Sandy loam

Depth to restrictive feature: None noted

Drainage class: Well drained

Parent material: Coarse-loamy alluvium

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 6.2 inches

Additional Components

Crago and similar soils: 5 percent

Scravo and similar soils: 5 percent

64E—Kalsted gravelly sandy loam, 15 to 35 percent slopes

Map Unit Setting

Elevation: 4,500 to 6,500 feet

Mean annual precipitation: 10 to 15 inches

Frost-free period: 90 to 110 days

Component Description

Kalsted and similar soils

Composition: 85 percent

Geomorphic description: Hill

Slope: 15 to 35 percent

Elevation: 4,500 to 6,500 feet

Effective annual precipitation: 10 to 15 inches

Frost-free period: 90 to 110 days

Surface layer texture: Gravelly sandy loam

Depth to restrictive feature: None noted

Drainage class: Well drained

Parent material: Coarse-loamy alluvium

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 5.3 inches

Additional Components

Kalsted, cobbly and similar soils: 3 percent
Musselshell and similar soils: 3 percent
Sandstone outcrop and similar soils: 3 percent
Varney and similar soils: 3 percent
Yetull and similar soils: 3 percent

77C—Sappington loam, 2 to 8 percent slopes

Map Unit Setting

Elevation: 5,000 to 5,400 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days

Component Description

Sappington and similar soils

Composition: 90 percent
Geomorphic description: Alluvial fan
Slope: 2 to 8 percent
Elevation: 5,000 to 5,400 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Loam
Depth to restrictive feature: None noted
Drainage class: Well drained
Parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 8.3 inches

Additional Components

Amesha and similar soils: 2 percent
Bronec and similar soils: 2 percent
Kalsted and similar soils: 2 percent
Nippt and similar soils: 2 percent

Component Description

Beavrock and similar soils

Composition: 1 percent
Geomorphic description: Flood plain and slough
Slope: 0 to 2 percent
Elevation: 5,000 to 5,400 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Silt loam
Depth to restrictive feature: None noted
Drainage class: Poorly drained
Parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Occasional

Water table: Present

Available water capacity: Mainly 5.4 inches

Additional Components

Varney and similar soils: 1 percent

83A—Dillon silt loam, 0 to 2 percent slopes

Map Unit Setting

Elevation: 4,800 to 6,000 feet

Mean annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Component Description

Dillon and similar soils

Composition: 85 percent

Geomorphic description: Flood plain and stream terrace

Slope: 0 to 2 percent

Elevation: 4,800 to 6,000 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Silt loam

Depth to restrictive feature: None noted

Drainage class: Somewhat poorly drained

Parent material: Alluvium

Native plant cover type: Rangeland

Flooding: Rare

Water table: Present

Available water capacity: Mainly 6.2 inches

Additional Components

Madbeaver and similar soils: 8 percent

Beavrock and similar soils: 3 percent

Ashbough and similar soils: 2 percent

Threeriv and similar soils: 1 percent

Water: 1 percent

84A—Madbeaver silt loam, 0 to 2 percent slopes

Map Unit Setting

Elevation: 4,800 to 5,600 feet

Mean annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Component Description

Madbeaver and similar soils

Composition: 85 percent

Geomorphic description: Alluvial fan and stream terrace

Slope: 0 to 2 percent

Elevation: 4,800 to 5,600 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days
Surface layer texture: Silt loam
Depth to restrictive feature: None noted
Drainage class: Somewhat poorly drained
Parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Water table: Present
Available water capacity: Mainly 8.0 inches

Additional Components

Ashbough and similar soils: 5 percent
Dillon and similar soils: 5 percent
Madbeaver, silty clay loam and similar soils: 3 percent
Beavrock and similar soils: 2 percent

85C—Trudau loam, 2 to 8 percent slopes

Map Unit Setting

Elevation: 4,800 to 5,400 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days

Component Description

Trudau and similar soils

Composition: 85 percent
Geomorphic description: Alluvial fan and stream terrace
Slope: 2 to 8 percent
Elevation: 4,800 to 5,400 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Loam
Depth to restrictive feature: None noted
Drainage class: Well drained
Parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 5.8 inches

Additional Components

Amesha and similar soils: 5 percent
Kalsted and similar soils: 5 percent
Yamacall and similar soils: 3 percent
Bronec and similar soils: 2 percent

89D—Nuley sandy loam, 2 to 12 percent slopes**Map Unit Setting**

Elevation: 4,500 to 6,500 feet

Mean annual precipitation: 10 to 14 inches

Frost-free period: 90 to 115 days

Component Description**Nuley and similar soils**

Composition: 85 percent

Geomorphic description: Hill and structural bench

Slope: 2 to 12 percent

Elevation: 4,500 to 6,500 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 115 days

Surface layer texture: Sandy loam

Depth to restrictive feature: Bedrock (lithic): 40 to 60 inches

Drainage class: Well drained

Parent material: Loamy residuum weathered from gneiss

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 3.6 inches

Additional Components

Udecide and similar soils: 10 percent

Rock outcrop: 5 percent

90C—Nuley clay loam, 2 to 8 percent slopes**Map Unit Setting**

Elevation: 4,500 to 6,500 feet

Mean annual precipitation: 10 to 14 inches

Frost-free period: 90 to 115 days

Component Description**Nuley and similar soils**

Composition: 85 percent

Geomorphic description: Hill and structural bench

Slope: 2 to 8 percent

Elevation: 4,500 to 6,500 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 115 days

Surface layer texture: Clay loam

Depth to restrictive feature: Bedrock (lithic): 40 to 60 inches

Drainage class: Well drained

Parent material: Loamy residuum weathered from gneiss

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 4.1 inches

Additional Components

Nuley, gravelly loam and similar soils: 5 percent
Nuley, sandy loam and similar soils: 4 percent
Rock outcrop: 3 percent
Udecide and similar soils: 3 percent

91E—Nuley-Rock outcrop complex, 8 to 35 percent slopes**Map Unit Setting**

Elevation: 4,300 to 6,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 90 to 115 days

Component Description**Nuley and similar soils**

Composition: 65 percent
Geomorphic description: Hill and structural bench
Slope: 8 to 35 percent
Elevation: 4,300 to 6,500 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 115 days
Surface layer texture: Sandy loam
Depth to restrictive feature: Bedrock (lithic): 40 to 60 inches
Drainage class: Well drained
Parent material: Loamy residuum weathered from gneiss
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.6 inches

Rock outcrop

Composition: 20 percent

Rentsac and similar soils

Composition: 10 percent
Geomorphic description: Shoulder on hill, backslope on hill, and ridge
Slope: 8 to 25 percent
Elevation: 4,300 to 6,500 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 115 days
Surface layer texture: Extremely channery loam
Depth to restrictive feature: Bedrock (lithic): 10 to 20 inches
Drainage class: Well drained
Parent material: Residuum weathered from calcareous sandstone
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.5 inches

Additional Components

Nuley, thick surface and similar soils: 5 percent

110A—Ryell-Rivra complex, cool, 0 to 2 percent slopes

Map Unit Setting

Elevation: 4,200 to 6,000 feet

Mean annual precipitation: 10 to 16 inches

Frost-free period: 90 to 115 days

Component Description

Ryell and similar soils

Composition: 60 percent

Geomorphic description: Flood plain and stream terrace

Slope: 0 to 2 percent

Elevation: 4,200 to 6,000 feet

Effective annual precipitation: 10 to 16 inches

Frost-free period: 90 to 110 days

Surface layer texture: Loam

Depth to restrictive feature: None noted

Drainage class: Well drained

Parent material: Loamy alluvium over sandy and gravelly alluvium

Native plant cover type: Rangeland

Flooding: Rare

Available water capacity: Mainly 5.0 inches

Rivra and similar soils

Composition: 20 percent

Geomorphic description: Stream terrace

Slope: 0 to 2 percent

Elevation: 4,200 to 6,000 feet

Effective annual precipitation: 10 to 16 inches

Frost-free period: 90 to 115 days

Surface layer texture: Gravelly sandy loam

Depth to restrictive feature: None noted

Drainage class: Well drained

Parent material: Sandy and gravelly alluvium

Native plant cover type: Rangeland

Flooding: Rare

Water table: Present

Available water capacity: Mainly 2.3 inches

Additional Components

Havre and similar soils: 8 percent

Rivra, wet and similar soils: 7 percent

Wetsand and similar soils: 5 percent

111B—Rivra complex, 0 to 4 percent slopes

Map Unit Setting

Elevation: 4,800 to 6,000 feet

Mean annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Component Description

Rivra, very cobbly and similar soils

Composition: 55 percent

Geomorphic description: Flood plain

Slope: 0 to 4 percent

Elevation: 4,800 to 6,000 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Very cobbly sandy loam

Depth to restrictive feature: None noted

Drainage class: Well drained

Parent material: Mixed alluvium

Native plant cover type: Rangeland

Flooding: Occasional

Water table: Present

Available water capacity: Mainly 2.1 inches

Rivra and similar soils

Composition: 30 percent

Geomorphic description: Flood plain

Slope: 0 to 4 percent

Elevation: 4,800 to 6,000 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Sandy loam

Depth to restrictive feature: None noted

Drainage class: Well drained

Parent material: Mixed alluvium

Native plant cover type: Rangeland

Flooding: Occasional

Water table: Present

Available water capacity: Mainly 2.2 inches

Additional Components

Ashbough and similar soils: 5 percent

Ryell and similar soils: 5 percent

Dillon and similar soils: 4 percent

Beavrock and similar soils: 1 percent

112B—Neen-Ashbough, saline-Beavrock complex, 0 to 4 percent slopes

Map Unit Setting

Elevation: 4,800 to 5,600 feet

Mean annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Component Description

Neen and similar soils

Composition: 40 percent

Geomorphic description: Flood plain and stream terrace

Slope: 2 to 4 percent

Elevation: 4,800 to 5,600 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Silt loam
Depth to restrictive feature: None noted
Drainage class: Somewhat poorly drained
Parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare
Water table: Present
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 7.6 inches

Ashbough, saline and similar soils

Composition: 25 percent
Geomorphic description: Flood plain and stream terrace
Slope: 0 to 2 percent
Elevation: 4,800 to 5,600 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Loam
Depth to restrictive feature: None noted
Drainage class: Moderately well drained
Parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Water table: Present
Available water capacity: Mainly 9.9 inches

Beavrock and similar soils

Composition: 20 percent
Geomorphic description: Drainageway and flood plain
Slope: 0 to 4 percent
Elevation: 4,800 to 5,600 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Silt loam
Depth to restrictive feature: None noted
Drainage class: Poorly drained
Parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare
Water table: Present
Available water capacity: Mainly 5.4 inches

Additional Components

Madbeaver and similar soils: 5 percent
Threeriv and similar soils: 5 percent
Dillon and similar soils: 4 percent
Water: 1 percent

117B—Ashbough silt loam, 0 to 4 percent slopes**Map Unit Setting**

Elevation: 5,000 to 5,500 feet

Mean annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Component Description**Ashbough and similar soils**

Composition: 90 percent

Geomorphic description: Flood plain and stream terrace

Slope: 0 to 4 percent

Elevation: 5,000 to 5,500 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Silt loam

Depth to restrictive feature: None noted

Drainage class: Moderately well drained

Parent material: Alluvium

Native plant cover type: Rangeland

Flooding: Very rare

Water table: Present

Available water capacity: Mainly 9.9 inches

Additional Components

Madbeaver and similar soils: 5 percent

Thess and similar soils: 3 percent

Yamacall and similar soils: 2 percent

127A—Bronec gravelly sandy loam, 0 to 2 percent slopes**Map Unit Setting**

Elevation: 5,000 to 5,500 feet

Mean annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Component Description**Bronec and similar soils**

Composition: 85 percent

Geomorphic description: Alluvial fan

Slope: 0 to 2 percent

Elevation: 5,000 to 5,500 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Gravelly sandy loam

Depth to restrictive feature: None noted

Drainage class: Well drained

Parent material: Alluvium

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 5.7 inches

Additional Components

Kalsted and similar soils: 3 percent
 Bronec, greater slopes and similar soils: 2 percent
 Bronec, cobbly and similar soils: 2 percent
 Bronec, loam and similar soils: 2 percent
 Kalsted and similar soils: 2 percent
 Scravo and similar soils: 2 percent
 Thess and similar soils: 2 percent

127C—Bronec gravelly sandy loam, 2 to 8 percent slopes

Map Unit Setting

Elevation: 4,800 to 6,200 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days

Component Description

Bronec and similar soils

Composition: 85 percent
Geomorphic description: Alluvial fan
Slope: 2 to 8 percent
Elevation: 4,800 to 6,200 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Gravelly sandy loam
Depth to restrictive feature: None noted
Drainage class: Well drained
Parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.7 inches

Additional Components

Kalsted and similar soils: 5 percent
 Bronec, greater slopes and similar soils: 3 percent
 Bronec, cobbly sandy loam and similar soils: 3 percent
 Bronec, loam and similar soils: 2 percent
 Scravo and similar soils: 2 percent

130A—Thess-Ashbough complex, 0 to 2 percent slopes

Map Unit Setting

Elevation: 4,800 to 5,600 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days

Component Description

Thess and similar soils

Composition: 50 percent
Geomorphic description: Alluvial fan and stream terrace
Slope: 0 to 2 percent

Elevation: 4,800 to 5,600 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Loam
Depth to restrictive feature: None noted
Drainage class: Well drained
Parent material: Mixed alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 6.3 inches

Ashbough and similar soils

Composition: 35 percent
Geomorphic description: Flood plain and stream terrace
Slope: 0 to 2 percent
Elevation: 4,800 to 5,600 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Silt loam
Depth to restrictive feature: None noted
Drainage class: Moderately well drained
Parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Very rare
Water table: Present
Available water capacity: Mainly 9.9 inches

Additional Components

Bronec and similar soils: 3 percent
Yamacall and similar soils: 3 percent
Amesha and similar soils: 2 percent
Dillon and similar soils: 2 percent
Havre and similar soils: 2 percent
Madbeaver and similar soils: 1 percent
Scravo and similar soils: 1 percent
Thessvo and similar soils: 1 percent

130B—Thess-Scravo complex, 0 to 4 percent slopes**Map Unit Setting**

Elevation: 5,000 to 6,000 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days

Component Description**Thess and similar soils**

Composition: 50 percent
Geomorphic description: Alluvial fan and fan terrace
Slope: 0 to 4 percent
Elevation: 5,000 to 6,000 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Loam

Depth to restrictive feature: None noted
Drainage class: Well drained
Parent material: Calcareous alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 6.3 inches

Scravo and similar soils

Composition: 30 percent
Geomorphic description: Alluvial fan and fan terrace
Slope: 0 to 4 percent
Elevation: 5,000 to 6,000 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Gravelly sandy loam
Depth to restrictive feature: None noted
Drainage class: Well drained
Parent material: Calcareous alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.2 inches

Additional Components

Bronec and similar soils: 5 percent
 Scravo, very gravelly sandy loam and similar soils: 5 percent
 Thessvo and similar soils: 5 percent
 Amesha and similar soils: 2 percent
 Nippt and similar soils: 2 percent
 Yamacall and similar soils: 1 percent

133C—Varney-Sappington complex, 2 to 8 percent slopes

Map Unit Setting

Elevation: 5,000 to 6,200 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days

Component Description

Varney and similar soils

Composition: 50 percent
Geomorphic description: Alluvial fan
Slope: 2 to 8 percent
Elevation: 5,000 to 6,200 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Loam
Depth to restrictive feature: None noted
Drainage class: Well drained
Parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 7.8 inches

Sappington and similar soils*Composition:* 40 percent*Geomorphic description:* Alluvial fan*Slope:* 2 to 8 percent*Elevation:* 5,000 to 6,200 feet*Effective annual precipitation:* 10 to 14 inches*Frost-free period:* 90 to 105 days*Surface layer texture:* Sandy clay loam*Depth to restrictive feature:* None noted*Drainage class:* Well drained*Parent material:* Alluvium*Native plant cover type:* Rangeland*Flooding:* None*Available water capacity:* Mainly 8.2 inches**Additional Components**

Amesha and similar soils: 5 percent

Kalsted and similar soils: 4 percent

Geohrock and similar soils: 1 percent

135D—Kalsted gravelly sandy loam, 4 to 15 percent slopes**Map Unit Setting***Elevation:* 4,800 to 6,100 feet*Mean annual precipitation:* 10 to 14 inches*Frost-free period:* 90 to 105 days**Component Description****Kalsted and similar soils***Composition:* 85 percent*Geomorphic description:* Alluvial fan*Slope:* 8 to 15 percent*Elevation:* 4,800 to 6,100 feet*Effective annual precipitation:* 10 to 14 inches*Frost-free period:* 90 to 105 days*Surface layer texture:* Gravelly sandy loam*Depth to restrictive feature:* None noted*Drainage class:* Well drained*Parent material:* Alluvium*Native plant cover type:* Rangeland*Flooding:* None*Available water capacity:* Mainly 6.9 inches**Additional Components**

Kalsted, loamy sand and similar soils: 8 percent

Scravo and similar soils: 5 percent

Amesha and similar soils: 1 percent

Rock outcrop: 1 percent

136C—Amesha-Kalsted complex, 2 to 8 percent slopes

Map Unit Setting

Elevation: 5,000 to 6,200 feet

Mean annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Component Description

Amesha and similar soils

Composition: 45 percent

Geomorphic description: Alluvial fan

Slope: 2 to 8 percent

Elevation: 5,000 to 6,200 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Loam

Depth to restrictive feature: None noted

Drainage class: Well drained

Parent material: Calcareous alluvium

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 9.3 inches

Kalsted and similar soils

Composition: 40 percent

Geomorphic description: Alluvial fan

Slope: 2 to 8 percent

Elevation: 5,000 to 6,200 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Sandy loam

Depth to restrictive feature: None noted

Drainage class: Well drained

Parent material: Calcareous alluvium

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 6.9 inches

Additional Components

Bronec and similar soils: 5 percent

Sappington and similar soils: 3 percent

Yamacall and similar soils: 3 percent

Thess and similar soils: 2 percent

Attewan and similar soils: 1 percent

Thess and similar soils: 1 percent

142B—Beavrock-Threeriv silt loams, 0 to 4 percent slopes

Map Unit Setting

Elevation: 4,800 to 5,300 feet

Mean annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Component Description

Beavrock and similar soils

Composition: 50 percent
Geomorphic description: Flood plain
Slope: 0 to 4 percent
Elevation: 4,800 to 5,300 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Silt loam
Depth to restrictive feature: None noted
Drainage class: Poorly drained
Parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Occasional
Water table: Present
Available water capacity: Mainly 5.4 inches

Threeriv and similar soils

Composition: 30 percent
Geomorphic description: Flood plain
Slope: 0 to 2 percent
Elevation: 4,800 to 5,300 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Silt loam
Depth to restrictive feature: None noted
Drainage class: Very poorly drained
Parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Frequent
Water table: Present
Available water capacity: Mainly 5.0 inches

Additional Components

Madbeaver and similar soils: 4 percent
Rivra and similar soils: 4 percent
Water: 4 percent
Ashbough and similar soils: 3 percent
Blossberg and similar soils: 2 percent
Dillon and similar soils: 2 percent
Newtman and similar soils: 1 percent

147C—Varney clay loam, 2 to 8 percent slopes

Map Unit Setting

Elevation: 4,300 to 6,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days

Component Description

Varney and similar soils

Composition: 90 percent

Geomorphic description: Alluvial fan, footslope on hill, and stream terrace

Slope: 2 to 8 percent

Elevation: 4,300 to 6,500 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Clay loam

Depth to restrictive feature: None noted

Drainage class: Well drained

Parent material: Fine-loamy alluvium

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 7.3 inches

Additional Components

Varney, silty clay loam and similar soils: 4 percent

Rock outcrop: 3 percent

Varney, cobbly and similar soils: 3 percent

148E—Rentsac, extremely bouldery-Rock outcrop complex, 15 to 45 percent slopes

Map Unit Setting

Elevation: 5,200 to 6,000 feet

Mean annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Component Description

Rentsac and similar soils

Composition: 50 percent

Geomorphic description: Strike ridge and hill

Slope: 15 to 45 percent

Elevation: 5,200 to 6,000 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Channery sandy loam

Rock fragments on the soil surface: 3 to 15 percent boulders

Depth to restrictive feature: Bedrock (lithic): 10 to 20 inches

Drainage class: Well drained

Parent material: Residuum

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 1.6 inches

Rock outcrop

Composition: 40 percent

Additional Components

Blacksheep and similar soils: 5 percent

Cabbart and similar soils: 5 percent

161A—Rivra, stony-Riverrun complex, 0 to 2 percent slopes

Map Unit Setting

Elevation: 5,180 to 5,400 feet

Mean annual precipitation: 10 to 12 inches

Frost-free period: 70 to 90 days

Component Description

Rivra, stony and similar soils

Composition: 50 percent

Geomorphic description: Stream terrace

Slope: 0 to 2 percent

Elevation: 5,180 to 5,400 feet

Effective annual precipitation: 10 to 12 inches

Frost-free period: 70 to 90 days

Surface layer texture: Very cobbly sandy loam

Rock fragments on the soil surface: 0.01 to 0.10 percent stones, 40 to 100 feet apart

Depth to restrictive feature: None noted

Drainage class: Well drained

Parent material: Sandy alluvium

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 3.1 inches

Riverrun and similar soils

Composition: 35 percent

Geomorphic description: Stream terrace

Slope: 0 to 1 percent

Elevation: 5,180 to 5,400 feet

Effective annual precipitation: 10 to 12 inches

Frost-free period: 70 to 90 days

Surface layer texture: Fine sandy loam

Depth to restrictive feature: None noted

Drainage class: Somewhat poorly drained

Parent material: Sandy alluvium

Native plant cover type: Rangeland

Flooding: Occasional

Water table: Present

Available water capacity: Mainly 3.6 inches

Additional Components

Meadowcreek, stony and similar soils: 8 percent

Vendome, very stony and similar soils: 5 percent

Anamac and similar soils: 2 percent

177C—Sappington-Kalsted complex, 2 to 8 percent slopes

Map Unit Setting

Elevation: 4,800 to 6,100 feet

Mean annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Component Description

Sappington and similar soils

Composition: 45 percent

Geomorphic description: Alluvial fan

Slope: 2 to 8 percent

Elevation: 4,800 to 6,100 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Sandy clay loam

Depth to restrictive feature: None noted

Drainage class: Well drained

Parent material: Alluvium

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 8.2 inches

Kalsted and similar soils

Composition: 40 percent

Geomorphic description: Alluvial fan

Slope: 2 to 8 percent

Elevation: 4,800 to 6,100 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Sandy loam

Depth to restrictive feature: None noted

Drainage class: Well drained

Parent material: Alluvium

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 6.9 inches

Additional Components

Amesha and similar soils: 5 percent

Sappington, lesser slopes and similar soils: 5 percent

Kalsted, greater slopes and similar soils: 2 percent

Scravo and similar soils: 2 percent

Thess and similar soils: 1 percent

180B—Thessvo-Scravo complex, 0 to 4 percent slopes**Map Unit Setting**

Elevation: 4,800 to 5,800 feet

Mean annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Component Description**Thessvo and similar soils**

Composition: 55 percent

Geomorphic description: Alluvial fan and stream terrace

Slope: 0 to 4 percent

Elevation: 4,800 to 5,800 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Loam

Depth to restrictive feature: None noted

Drainage class: Well drained

Parent material: Alluvium

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 3.6 inches

Scravo and similar soils

Composition: 30 percent

Geomorphic description: Alluvial fan and stream terrace

Slope: 0 to 4 percent

Elevation: 4,800 to 5,800 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Gravelly sandy loam

Depth to restrictive feature: None noted

Drainage class: Well drained

Parent material: Alluvium

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 2.2 inches

Additional Components

Thess and similar soils: 7 percent

Scravo, stony and similar soils: 5 percent

Scravo, very gravelly and similar soils: 2 percent

Nippt and similar soils: 1 percent

181B—Nippt-Scravo-Nippt complex, 0 to 4 percent slopes**Map Unit Setting**

Elevation: 4,800 to 6,200 feet

Mean annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Component Description

Nippt and similar soils

Composition: 30 percent

Geomorphic description: Alluvial fan and stream terrace

Slope: 0 to 4 percent

Elevation: 4,800 to 6,200 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Gravelly sandy loam

Depth to restrictive feature: None noted

Drainage class: Well drained

Parent material: Alluvium

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 2.8 inches

Scravo and similar soils

Composition: 30 percent

Geomorphic description: Alluvial fan and stream terrace

Slope: 0 to 4 percent

Elevation: 4,800 to 6,200 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Gravelly sandy loam

Depth to restrictive feature: None noted

Drainage class: Well drained

Parent material: Alluvium

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 2.2 inches

Nippt, very cobbly and similar soils

Composition: 20 percent

Geomorphic description: Alluvial fan and stream terrace

Slope: 0 to 4 percent

Elevation: 4,800 to 6,200 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Very cobbly loam

Depth to restrictive feature: None noted

Drainage class: Well drained

Parent material: Alluvium

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 2.6 inches

Additional Components

Bronec and similar soils: 8 percent

Thessvo and similar soils: 6 percent

Attewan and similar soils: 5 percent

Scravo, greater slopes and similar soils: 1 percent

182B—Dillon-Ashbough-Beavrock silt loams, 0 to 4 percent slopes

Map Unit Setting

Elevation: 4,800 to 5,600 feet

Mean annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Component Description

Dillon and similar soils

Composition: 35 percent

Geomorphic description: Flood plain and stream terrace

Slope: 0 to 4 percent

Elevation: 4,800 to 5,600 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Silt loam

Depth to restrictive feature: None noted

Drainage class: Somewhat poorly drained

Parent material: Alluvium

Native plant cover type: Rangeland

Flooding: Rare

Water table: Present

Available water capacity: Mainly 6.2 inches

Ashbough and similar soils

Composition: 30 percent

Geomorphic description: Flood plain and stream terrace

Slope: 0 to 4 percent

Elevation: 4,800 to 5,600 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Silt loam

Depth to restrictive feature: None noted

Drainage class: Moderately well drained

Parent material: Alluvium

Native plant cover type: Rangeland

Flooding: Rare

Water table: Present

Available water capacity: Mainly 9.9 inches

Beavrock and similar soils

Composition: 20 percent

Geomorphic description: Flood plain

Slope: 0 to 4 percent

Elevation: 4,800 to 5,600 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Silt loam

Depth to restrictive feature: None noted

Drainage class: Poorly drained

Parent material: Alluvium

Native plant cover type: Rangeland

Flooding: Rare
Water table: Present
Available water capacity: Mainly 5.4 inches

Additional Components

Ryell and similar soils: 5 percent
 Madbeaver and similar soils: 2 percent
 Threeriv and similar soils: 2 percent
 Wetsand and similar soils: 2 percent
 Amesha and similar soils: 1 percent
 Thessvo and similar soils: 1 percent
 Trudau and similar soils: 1 percent
 Water: 1 percent

183B—Dillon-Rivra-Beavrock complex, 0 to 4 percent slopes

Map Unit Setting

Elevation: 4,800 to 5,600 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days

Component Description

Dillon and similar soils

Composition: 50 percent
Geomorphic description: Flood plain and stream terrace
Slope: 0 to 4 percent
Elevation: 4,800 to 5,600 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Silt loam
Depth to restrictive feature: None noted
Drainage class: Somewhat poorly drained
Parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Water table: Present
Available water capacity: Mainly 6.2 inches

Rivra and similar soils

Composition: 25 percent
Geomorphic description: Flood plain
Slope: 0 to 4 percent
Elevation: 4,800 to 5,600 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Gravelly sandy loam
Depth to restrictive feature: None noted
Drainage class: Well drained
Parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare

Water table: Present

Available water capacity: Mainly 2.2 inches

Beavrock and similar soils

Composition: 15 percent

Geomorphic description: Flood plain

Slope: 0 to 4 percent

Elevation: 4,800 to 5,600 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Silt loam

Depth to restrictive feature: None noted

Drainage class: Poorly drained

Parent material: Alluvium

Native plant cover type: Rangeland

Flooding: Rare

Water table: Present

Available water capacity: Mainly 5.4 inches

Additional Components

Blossberg and similar soils: 2 percent

Madbeaver and similar soils: 2 percent

Scravo and similar soils: 2 percent

Thess and similar soils: 2 percent

Threeriv and similar soils: 1 percent

Water: 1 percent

187C—Chinook-Glendive sandy loams, 0 to 8 percent slopes

Map Unit Setting

Elevation: 4,800 to 6,000 feet

Mean annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Component Description

Chinook and similar soils

Composition: 60 percent

Geomorphic description: Alluvial fan and stream terrace

Slope: 2 to 8 percent

Elevation: 4,800 to 6,000 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Sandy loam

Depth to restrictive feature: None noted

Drainage class: Well drained

Parent material: Alluvium

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 6.4 inches

Glendive and similar soils

Composition: 20 percent
Geomorphic description: Drainageway
Slope: 0 to 2 percent
Elevation: 4,800 to 6,000 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Sandy loam
Depth to restrictive feature: None noted
Drainage class: Well drained
Parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 7.9 inches

Additional Components

Kalsted and similar soils: 5 percent
 Amesha and similar soils: 4 percent
 Bronec and similar soils: 3 percent
 Kalsted and similar soils: 3 percent
 Rivra and similar soils: 2 percent
 Varney and similar soils: 2 percent
 Dillon and similar soils: 1 percent

189E—Geohrock, bouldery-Sappington, stony-Bronec, bouldery complex, 8 to 35 percent slopes

Map Unit Setting

Elevation: 5,000 to 6,200 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days

Component Description**Geohrock, bouldery and similar soils**

Composition: 45 percent
Geomorphic description: Hill
Slope: 8 to 35 percent
Elevation: 5,000 to 6,200 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Very cobbly loam
Rock fragments on the soil surface: 0.01 to 0.10 percent boulders
Depth to restrictive feature: None noted
Drainage class: Well drained
Parent material: Outwash and/or gravelly slope alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.9 inches

Sappington and similar soils

Composition: 25 percent
Geomorphic description: Hill

Slope: 8 to 25 percent
Elevation: 5,000 to 6,200 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Cobbly sandy loam
Rock fragments on the soil surface: 0.01 to 0.10 percent stones
Depth to restrictive feature: None noted
Drainage class: Well drained
Parent material: Outwash
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 8.0 inches

Bronec and similar soils

Composition: 20 percent
Geomorphic description: Hill
Slope: 8 to 35 percent
Elevation: 5,000 to 6,200 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Very cobbly loam
Rock fragments on the soil surface: 0.01 to 0.10 percent boulders
Depth to restrictive feature: None noted
Drainage class: Well drained
Parent material: Outwash
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.6 inches

Additional Components

Geohrock, stony and similar soils: 6 percent
 Blackleaf and similar soils: 2 percent
 Twinadams and similar soils: 2 percent

190E—Blackleaf, stony-Twinadams-Rock outcrop complex, 8 to 35 percent slopes

Map Unit Setting

Elevation: 5,500 to 6,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 70 to 90 days

Component Description

Blackleaf and similar soils

Composition: 30 percent
Geomorphic description: Strike ridge
Slope: 8 to 35 percent
Elevation: 5,500 to 6,500 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 70 to 90 days
Surface layer texture: Very channery sandy loam
Rock fragments on the soil surface: 0.01 to 0.10 percent stones

Depth to restrictive feature: Bedrock (lithic): 10 to 20 inches

Drainage class: Well drained

Parent material: Residuum over sandstone and/or siltstone and/or shale

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 1.1 inches

Twinadams and similar soils

Composition: 25 percent

Geomorphic description: Strike ridge

Slope: 8 to 35 percent

Elevation: 5,500 to 6,500 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 70 to 90 days

Surface layer texture: Gravelly loam

Depth to restrictive feature:

- *Bedrock (paralithic):* 20 to 36 inches
- *Bedrock (lithic):* 30 to 40 inches

Drainage class: Well drained

Parent material: Residuum over sandstone and/or siltstone and/or shale

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 1.9 inches

Rock outcrop

Composition: 20 percent

Additional Components

Zbart and similar soils: 8 percent

Component Description

Pensore and similar soils

Composition: 7 percent

Geomorphic description: Hill

Slope: 4 to 45 percent

Elevation: 5,500 to 6,500 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 70 to 90 days

Surface layer texture: Channery loam

Depth to restrictive feature: Bedrock (lithic): 10 to 20 inches

Drainage class: Well drained

Parent material: Residuum weathered from limestone

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 1.3 inches

Additional Components

Haxby and similar soils: 4 percent

Rencot and similar soils: 4 percent

Twinadams, stony and similar soils: 2 percent

191D—Haxby-Kalsted-Zbart complex, 4 to 15 percent slopes

Map Unit Setting

Elevation: 5,200 to 5,800 feet

Mean annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Component Description

Haxby and similar soils

Composition: 40 percent

Geomorphic description: Structural bench

Slope: 4 to 15 percent

Elevation: 5,200 to 5,800 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Loam

Depth to restrictive feature: Bedrock (lithic): 20 to 40 inches

Drainage class: Well drained

Parent material: Alluvium derived from calcareous sandstone over residuum weathered from argillite

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 3.4 inches

Kalsted and similar soils

Composition: 25 percent

Geomorphic description: Hill

Slope: 4 to 15 percent

Elevation: 5,200 to 5,800 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Gravelly sandy loam

Drainage class: Well drained

Parent material: Alluvium

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 6.9 inches

Zbart and similar soils

Composition: 15 percent

Geomorphic description: Structural bench

Slope: 4 to 15 percent

Elevation: 5,200 to 5,800 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Very channery sandy loam

Depth to restrictive feature: Bedrock (lithic): 5 to 10 inches

Drainage class: Somewhat excessively drained

Parent material: Residuum over sandstone and/or siltstone and/or shale

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 0.6 inches

Additional Components

Amesha and similar soils: 8 percent
 Rencot and similar soils: 5 percent
 Cabbart and similar soils: 3 percent
 Haxby, greater slopes and similar soils: 2 percent
 Udecide and similar soils: 2 percent

193A—Attewan-Nippt complex, 0 to 2 percent slopes

Map Unit Setting

Elevation: 4,800 to 6,000 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days

Component Description

Attewan and similar soils

Composition: 60 percent
Geomorphic description: Alluvial fan and stream terrace
Slope: 0 to 2 percent
Elevation: 4,800 to 6,000 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Loam
Drainage class: Well drained
Parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.5 inches

Nippt and similar soils

Composition: 20 percent
Geomorphic description: Alluvial fan and stream terrace
Slope: 0 to 2 percent
Elevation: 4,800 to 6,000 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Gravelly loam
Drainage class: Well drained
Parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.7 inches

Additional Components

Varney and similar soils: 5 percent
 Nippt, greater slopes and similar soils: 3 percent
 Thess and similar soils: 3 percent
 Thessvo and similar soils: 3 percent
 Brockway and similar soils: 2 percent
 Dillon and similar soils: 2 percent
 Madbeaver and similar soils: 2 percent

194D—Musselshell-Roto-Pensore complex, 4 to 15 percent slopes

Map Unit Setting

Elevation: 5,000 to 6,000 feet

Mean annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Component Description

Musselshell and similar soils

Composition: 45 percent

Geomorphic description: Alluvial fan

Slope: 4 to 15 percent

Elevation: 5,000 to 6,000 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Loam

Drainage class: Well drained

Parent material: Alluvium derived from limestone over colluvium derived from limestone

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 8.0 inches

Roto and similar soils

Composition: 25 percent

Geomorphic description: Structural bench

Slope: 4 to 15 percent

Elevation: 5,000 to 6,000 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Gravelly loam

Depth to restrictive feature: Bedrock (lithic): 20 to 40 inches

Drainage class: Well drained

Parent material: Alluvium over residuum derived from limestone

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 3.0 inches

Pensore and similar soils

Composition: 15 percent

Geomorphic description: Hill

Slope: 4 to 15 percent

Elevation: 5,000 to 6,000 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Gravelly loam

Depth to restrictive feature: Bedrock (lithic): 10 to 20 inches

Drainage class: Well drained

Parent material: Alluvium over residuum derived from limestone

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 1.3 inches

Additional Components

Haxby and similar soils: 7 percent
Crago and similar soils: 5 percent
Rock outcrop: 3 percent

195B—Dillon, saline-Dillon-Riverrun, saline complex, 0 to 4 percent slopes

Map Unit Setting

Elevation: 4,800 to 5,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days

Component Description

Dillon, saline and similar soils

Composition: 40 percent
Geomorphic description: Flood plain and stream terrace
Slope: 0 to 4 percent
Elevation: 4,800 to 5,500 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Silt loam
Drainage class: Somewhat poorly drained
Parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare
Water table: Present
Available water capacity: Mainly 6.2 inches

Dillon and similar soils

Composition: 25 percent
Geomorphic description: Flood plain and stream terrace
Slope: 0 to 4 percent
Elevation: 4,800 to 5,500 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Loam
Drainage class: Somewhat poorly drained
Parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare
Water table: Present
Available water capacity: Mainly 6.1 inches

Riverrun and similar soils

Composition: 20 percent
Geomorphic description: Flood plain
Slope: 0 to 4 percent
Elevation: 4,800 to 5,500 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Loam

Drainage class: Moderately well drained
Parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare
Water table: Present
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 2.4 inches

Additional Components

Ashbough, saline and similar soils: 3 percent
Beavrock and similar soils: 3 percent
Madbeaver and similar soils: 3 percent
Neen and similar soils: 3 percent
Trudau and similar soils: 2 percent
Threeriv and similar soils: 1 percent

198E—Cabbart, very stony-Rentsac, bouldery-Rock outcrop complex, 15 to 45 percent slopes

Map Unit Setting

Elevation: 4,900 to 6,000 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days

Component Description

Cabbart and similar soils

Composition: 35 percent
Geomorphic description: Strike ridge
Slope: 15 to 45 percent
Elevation: 4,900 to 5,300 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Cobbly loam
Rock fragments on the soil surface: 0.10 to 3.00 percent stones
Depth to restrictive feature: Bedrock (paralithic): 10 to 20 inches
Drainage class: Well drained
Parent material: Residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.7 inches

Rentsac and similar soils

Composition: 30 percent
Geomorphic description: Strike ridge
Slope: 15 to 45 percent
Elevation: 4,900 to 5,300 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Channery sandy loam
Rock fragments on the soil surface: 0.01 to 0.10 percent boulders
Depth to restrictive feature: Bedrock (lithic): 10 to 20 inches

Drainage class: Well drained
Parent material: Residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.6 inches

Rock outcrop

Composition: 25 percent

Additional Components

Blacksheep and similar soils: 5 percent
Haxby and similar soils: 5 percent

217B—Havre-Glendive complex, 0 to 4 percent slopes**Map Unit Setting**

Elevation: 4,800 to 5,400 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days

Component Description**Havre and similar soils**

Composition: 50 percent
Geomorphic description: Alluvial fan and stream terrace
Slope: 0 to 4 percent
Elevation: 4,800 to 5,400 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Loam
Drainage class: Well drained
Parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.4 inches

Glendive and similar soils

Composition: 35 percent
Geomorphic description: Stream terrace
Slope: 0 to 4 percent
Elevation: 4,800 to 5,400 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Sandy loam
Drainage class: Well drained
Parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 7.9 inches

Additional Components

Beavrock and similar soils: 5 percent
Dillon and similar soils: 5 percent
Rivra and similar soils: 2 percent

Threeriv and similar soils: 2 percent

Water: 1 percent

225B—Scravo cobbly loam, 0 to 4 percent slopes

Map Unit Setting

Elevation: 5,000 to 6,000 feet

Mean annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Component Description

Scravo and similar soils

Composition: 85 percent

Geomorphic description: Alluvial fan and stream terrace

Slope: 0 to 4 percent

Elevation: 5,000 to 6,000 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Gravelly sandy loam

Drainage class: Well drained

Parent material: Calcareous alluvium

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 2.2 inches

Additional Components

Thess and similar soils: 5 percent

Thessvo and similar soils: 5 percent

Scravo, very stony and similar soils: 2 percent

Attewan and similar soils: 1 percent

Nippt and similar soils: 1 percent

Scravo, stony and similar soils: 1 percent

227B—Bronec cobbly loam, 0 to 4 percent slopes

Map Unit Setting

Elevation: 4,800 to 6,200 feet

Mean annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Component Description

Bronec and similar soils

Composition: 85 percent

Geomorphic description: Alluvial fan and stream terrace

Slope: 0 to 4 percent

Elevation: 4,800 to 6,200 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Cobbly loam

Drainage class: Well drained

Parent material: Sandy and gravelly calcareous tertiary valley fill alluvium

Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.9 inches

Additional Components

Scravo and similar soils: 10 percent
 Bronec, greater slopes and similar soils: 5 percent

227C—Bronec-Kalsted gravelly sandy loams, stony, 2 to 8 percent slopes

Map Unit Setting

Elevation: 5,000 to 6,200 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days

Component Description

Bronec and similar soils

Composition: 60 percent
Geomorphic description: Alluvial fan
Slope: 2 to 8 percent
Elevation: 5,000 to 6,200 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Gravelly sandy loam
Rock fragments on the soil surface: 0.01 to 0.10 percent stones
Drainage class: Well drained
Parent material: Calcareous alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.6 inches

Kalsted and similar soils

Composition: 25 percent
Geomorphic description: Alluvial fan
Slope: 2 to 8 percent
Elevation: 5,000 to 6,200 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Gravelly sandy loam
Rock fragments on the soil surface: 0.01 to 0.10 percent stones
Drainage class: Well drained
Parent material: Calcareous alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 6.9 inches

Additional Components

Bronec and similar soils: 5 percent
 Kalsted and similar soils: 5 percent
 Thess and similar soils: 2 percent
 Bronec, very stony and similar soils: 1 percent

Bronec, bouldery and similar soils: 1 percent

Geohrock and similar soils: 1 percent

233C—Varney-Sappington-Kalsted, stony complex, 2 to 8 percent slopes

Map Unit Setting

Elevation: 5,000 to 6,200 feet

Mean annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Component Description

Varney and similar soils

Composition: 45 percent

Geomorphic description: Alluvial fan

Slope: 2 to 8 percent

Elevation: 5,000 to 6,200 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Loam

Drainage class: Well drained

Parent material: Alluvium

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 7.9 inches

Sappington and similar soils

Composition: 30 percent

Geomorphic description: Alluvial fan

Slope: 2 to 8 percent

Elevation: 5,000 to 6,200 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Sandy clay loam

Drainage class: Well drained

Parent material: Alluvium

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 8.2 inches

Kalsted and similar soils

Composition: 20 percent

Geomorphic description: Alluvial fan

Slope: 2 to 8 percent

Elevation: 5,000 to 6,200 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Gravelly sandy loam

Rock fragments on the soil surface: 0.01 to 0.10 percent stones

Drainage class: Well drained

Parent material: Alluvium

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 6.9 inches

Additional Components

Amesha and similar soils: 2 percent

Yamacall and similar soils: 2 percent

Udecide and similar soils: 1 percent

241F—Whitlash, very stony-Rock outcrop-Perma, very stony complex, 25 to 60 percent slopes

Map Unit Setting

Elevation: 5,600 to 6,200 feet

Mean annual precipitation: 15 to 19 inches

Frost-free period: 70 to 90 days

Component Description

Whitlash and similar soils

Composition: 50 percent

Geomorphic description: Escarpment, hillside, and ridge

Slope: 25 to 60 percent

Elevation: 5,600 to 6,200 feet

Effective annual precipitation: 15 to 19 inches

Frost-free period: 70 to 90 days

Surface layer texture: Very cobbly loam

Rock fragments on the soil surface: 0.10 to 3.00 percent stones

Depth to restrictive feature: Bedrock (lithic): 10 to 20 inches

Drainage class: Well drained

Parent material: Gravelly residuum weathered from fine-grained sandstone

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 0.9 inches

Rock outcrop (volcanic)

Composition: 25 percent

Definition: Rock outcrop consists mainly of exposed areas of hard, fractured, fine-grained volcanic extrusive bedrock. Boulders and stones occupy a small part of the area.

Perma and similar soils

Composition: 15 percent

Geomorphic description: Escarpment, hillside, and ridge

Slope: 25 to 60 percent

Elevation: 5,600 to 6,200 feet

Effective annual precipitation: 15 to 19 inches

Frost-free period: 70 to 90 days

Surface layer texture: Cobbly loam

Rock fragments on the soil surface: 0.10 to 3.00 percent stones

Drainage class: Somewhat excessively drained

Parent material: Gravelly colluvium derived from basalt

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 5.1 inches

Additional Components

Brickner and similar soils: 5 percent

Wickes and similar soils: 5 percent

242B—Beavrock-Dillon silt loams, 0 to 4 percent slopes

Map Unit Setting

Elevation: 4,800 to 5,300 feet

Mean annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Component Description

Beavrock and similar soils

Composition: 55 percent

Geomorphic description: Flood plain

Slope: 0 to 4 percent

Elevation: 4,800 to 5,300 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Silt loam

Drainage class: Poorly drained

Parent material: Alluvium

Native plant cover type: Rangeland

Flooding: Rare

Water table: Present

Available water capacity: Mainly 5.4 inches

Dillon and similar soils

Composition: 30 percent

Geomorphic description: Flood plain and stream terrace

Slope: 0 to 4 percent

Elevation: 4,800 to 5,300 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Silt loam

Drainage class: Somewhat poorly drained

Parent material: Alluvium

Native plant cover type: Rangeland

Flooding: Rare

Water table: Present

Available water capacity: Mainly 6.2 inches

Additional Components

Blossberg and similar soils: 3 percent

Rivra and similar soils: 3 percent

Threeriv and similar soils: 3 percent

Component Description

Ashbough and similar soils

Composition: 2 percent

Geomorphic description: Flood plain and stream terrace

Slope: 0 to 4 percent

Elevation: 4,800 to 5,300 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Silt loam

Drainage class: Moderately well drained

Parent material: Alluvium

Native plant cover type: Rangeland

Flooding: Rare

Water table: Present

Available water capacity: Mainly 9.9 inches

Additional Components

Madbeaver and similar soils: 2 percent

Water: 2 percent

270E—Pensore-Crago-Rock outcrop complex, 8 to 45 percent slopes

Map Unit Setting

Elevation: 5,200 to 6,000 feet

Mean annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Component Description

Pensore and similar soils

Composition: 45 percent

Geomorphic description: Hill

Slope: 8 to 45 percent

Elevation: 5,200 to 5,600 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Channery loam

Depth to restrictive feature: Bedrock (lithic): 10 to 20 inches

Drainage class: Well drained

Parent material: Residuum weathered from limestone

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 1.3 inches

Crago and similar soils

Composition: 20 percent

Geomorphic description: Hillside

Slope: 8 to 15 percent

Elevation: 5,200 to 5,600 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Gravelly loam

Drainage class: Well drained
Parent material: Alluvium derived from limestone
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.8 inches

Rock outcrop

Composition: 20 percent

Additional Components

Amesha and similar soils: 5 percent
Blacksheep and similar soils: 5 percent
Roto and similar soils: 5 percent

**272F—Rencot, stony-Spudbar-Rock outcrop complex,
25 to 50 percent slopes****Map Unit Setting**

Elevation: 5,000 to 6,400 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days

Component Description**Rencot and similar soils**

Composition: 30 percent
Geomorphic description: Hill
Slope: 25 to 50 percent
Elevation: 5,000 to 6,400 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Very cobbly loam
Rock fragments on the soil surface: 0.01 to 0.10 percent stones
Depth to restrictive feature: Bedrock (lithic): 10 to 20 inches
Drainage class: Well drained
Parent material: Residuum and/or colluvium derived from rhyolite
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.4 inches

Spudbar and similar soils

Composition: 20 percent
Geomorphic description: Hill
Slope: 25 to 50 percent
Elevation: 5,000 to 6,400 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Very cobbly loam
Depth to restrictive feature: Bedrock (lithic): 20 to 40 inches
Drainage class: Well drained
Parent material: Residuum weathered from sandstone, siltstone, or shale
Native plant cover type: Rangeland
Available water capacity: Mainly 2.1 inches

Rock outcrop

Composition: 15 percent

Additional Components

Rubble land: 10 percent

Rencot, very stony and similar soils: 9 percent

Spudbar, lesser slopes and similar soils: 8 percent

Zbart and similar soils: 5 percent

Bronec and similar soils: 2 percent

Blackleaf and similar soils: 1 percent

**277C—Sappington-Kalsted-Kalsted, stony complex,
2 to 8 percent slopes****Map Unit Setting**

Elevation: 5,000 to 6,200 feet

Mean annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Component Description**Sappington and similar soils**

Composition: 40 percent

Geomorphic description: Alluvial fan

Slope: 2 to 8 percent

Elevation: 5,000 to 6,200 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Sandy clay loam

Drainage class: Well drained

Parent material: Alluvium

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 8.2 inches

Kalsted and similar soils

Composition: 25 percent

Geomorphic description: Alluvial fan

Slope: 2 to 8 percent

Elevation: 5,000 to 6,200 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Sandy loam

Drainage class: Well drained

Parent material: Alluvium

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 6.9 inches

Kalsted, cobbly and similar soils

Composition: 20 percent

Geomorphic description: Alluvial fan

Slope: 2 to 8 percent

Elevation: 5,000 to 6,200 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Cobbly sandy loam
Rock fragments on the soil surface: 0.01 to 0.10 percent stones
Drainage class: Well drained
Parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 6.9 inches

Additional Components

Amesha and similar soils: 5 percent
Varney and similar soils: 4 percent
Bronec and similar soils: 3 percent
Kalsted, very stony and similar soils: 1 percent
Nippt and similar soils: 1 percent
Yamacall and similar soils: 1 percent

278D—Sappington-Geohrock-Delpoint, stony complex, 4 to 25 percent slopes

Map Unit Setting

Elevation: 5,000 to 6,000 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days

Component Description

Sappington and similar soils

Composition: 30 percent
Geomorphic description: Alluvial fan
Slope: 4 to 8 percent
Elevation: 5,000 to 6,000 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Loam
Drainage class: Well drained
Parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 8.3 inches

Geohrock and similar soils

Composition: 25 percent
Geomorphic description: Hill
Slope: 4 to 15 percent
Elevation: 5,000 to 6,000 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Gravelly sandy loam
Drainage class: Well drained
Parent material: Alluvium

Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.1 inches

Delpoint and similar soils

Composition: 20 percent
Geomorphic description: Hillside
Slope: 15 to 25 percent
Elevation: 5,000 to 6,000 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Clay loam
Rock fragments on the soil surface: 35 to 60 percent cobbles; 0.01 to 0.10 percent stones
Depth to restrictive feature: Bedrock (paralithic): 20 to 40 inches
Drainage class: Well drained
Parent material: Alluvium over residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.3 inches

Additional Components

Cabbart and similar soils: 5 percent
 Blackleaf and similar soils: 4 percent
 Bronec and similar soils: 4 percent
 Varney and similar soils: 4 percent
 Amesha and similar soils: 3 percent
 Udecide and similar soils: 3 percent
 Attewan and similar soils: 1 percent
 Rock outcrop: 1 percent

**289E—Geohrock-Bronec-Geohrock, stony complex,
 8 to 45 percent slopes**

Map Unit Setting

Elevation: 5,000 to 6,200 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days

Component Description

Geohrock and similar soils

Composition: 40 percent
Geomorphic description: Hillside
Slope: 8 to 45 percent
Elevation: 5,000 to 6,200 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Very cobbly loam
Drainage class: Well drained
Parent material: Alluvium
Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 3.9 inches

Bronec and similar soils

Composition: 30 percent

Geomorphic description: Hillside

Slope: 8 to 45 percent

Elevation: 5,000 to 6,200 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Very gravelly sandy loam

Drainage class: Well drained

Parent material: Alluvium

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 5.4 inches

Geohrock and similar soils

Composition: 15 percent

Geomorphic description: Hillside

Slope: 8 to 45 percent

Elevation: 5,000 to 6,200 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Very cobbly loam

Rock fragments on the soil surface: 0.01 to 0.10 percent stones

Drainage class: Well drained

Parent material: Alluvium

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 3.9 inches

Additional Components

Geohrock, very stony and similar soils: 4 percent

Bronec, lesser slopes and similar soils: 3 percent

Geohrock, bouldery and similar soils: 2 percent

Kalsted and similar soils: 2 percent

Rencot and similar soils: 2 percent

Sappington and similar soils: 2 percent

291E—Haxby-Blackleaf-Zbart complex, 4 to 25 percent slopes

Map Unit Setting

Elevation: 5,500 to 6,500 feet

Mean annual precipitation: 10 to 14 inches

Frost-free period: 70 to 90 days

Component Description

Haxby and similar soils

Composition: 30 percent

Geomorphic description: Strike ridge

Slope: 4 to 25 percent
Elevation: 5,500 to 6,500 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 70 to 90 days
Surface layer texture: Loam
Depth to restrictive feature: Bedrock (lithic): 20 to 40 inches
Drainage class: Well drained
Parent material: Residuum over sandstone and/or siltstone and/or shale
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.4 inches

Blackleaf and similar soils

Composition: 25 percent
Geomorphic description: Strike ridge
Slope: 4 to 25 percent
Elevation: 5,500 to 6,500 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 70 to 90 days
Surface layer texture: Very channery sandy loam
Rock fragments on the soil surface: 0.01 to 0.10 percent stones
Depth to restrictive feature: Bedrock (lithic): 10 to 20 inches
Drainage class: Well drained
Parent material: Residuum over sandstone and/or siltstone and/or shale
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.1 inches

Zbart and similar soils

Composition: 25 percent
Geomorphic description: Strike ridge
Slope: 4 to 25 percent
Elevation: 5,500 to 6,500 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 70 to 90 days
Surface layer texture: Very channery sandy loam
Depth to restrictive feature: Bedrock (lithic): 5 to 10 inches
Drainage class: Somewhat excessively drained
Parent material: Residuum over sandstone and/or siltstone and/or shale
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 0.6 inches

Additional Components

Rock outcrop: 5 percent
 Haxby, greater slopes and similar soils: 4 percent
 Rencot and similar soils: 4 percent
 Twinadams and similar soils: 4 percent
 Pensore and similar soils: 3 percent

327E—Bronec-Spudbar-Rencot complex, 8 to 35 percent slopes

Map Unit Setting

Elevation: 5,000 to 6,400 feet

Mean annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Component Description

Bronec and similar soils

Composition: 40 percent

Geomorphic description: Hill and ridge

Slope: 8 to 35 percent

Elevation: 5,000 to 6,400 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Gravelly loam

Drainage class: Well drained

Parent material: Alluvium

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 5.9 inches

Spudbar and similar soils

Composition: 25 percent

Geomorphic description: Hill and ridge

Slope: 8 to 35 percent

Elevation: 5,000 to 6,400 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Very cobbly loam

Depth to restrictive feature: Bedrock (lithic): 20 to 40 inches

Drainage class: Well drained

Parent material: Colluvium over residuum weathered from sandstone

Native plant cover type: Rangeland

Available water capacity: Mainly 2.1 inches

Rencot and similar soils

Composition: 15 percent

Geomorphic description: Hill and ridge

Slope: 8 to 35 percent

Elevation: 5,000 to 6,400 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Very cobbly loam

Depth to restrictive feature: Bedrock (lithic): 10 to 20 inches

Drainage class: Well drained

Parent material: Residuum weathered from sandstone

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 1.4 inches

Additional Components

Bronec, very stony and similar soils: 7 percent
Spudbar, greater slopes and similar soils: 4 percent
Kalsted and similar soils: 3 percent
Amesha and similar soils: 2 percent
Rock outcrop: 2 percent
Blackleaf and similar soils: 1 percent
Bronec, bouldery and similar soils: 1 percent

331C—Geohrock-Bronec gravelly loams, 2 to 8 percent slopes

Map Unit Setting

Elevation: 5,000 to 6,000 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days

Component Description

Geohrock and similar soils

Composition: 45 percent
Geomorphic description: Alluvial fan
Slope: 2 to 8 percent
Elevation: 5,000 to 6,000 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Gravelly loam
Drainage class: Well drained
Parent material: Gravelly tertiary valley fill alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.1 inches

Bronec and similar soils

Composition: 40 percent
Geomorphic description: Alluvial fan
Slope: 2 to 8 percent
Elevation: 5,000 to 6,000 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Gravelly loam
Drainage class: Well drained
Parent material: Sandy and gravelly calcareous tertiary valley fill alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.9 inches

Additional Components

Geohrock, stony and similar soils: 5 percent
Bronec, very stony and similar soils: 4 percent
Amesha and similar soils: 3 percent
Sappington and similar soils: 3 percent

333E—Varney-Delpoint, stony-Geohrock complex, 4 to 35 percent slopes

Map Unit Setting

Elevation: 5,000 to 6,200 feet

Mean annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Component Description

Varney and similar soils

Composition: 35 percent

Geomorphic description: Hillside

Slope: 4 to 15 percent

Elevation: 5,000 to 6,200 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Loam

Drainage class: Well drained

Parent material: Alluvium

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 7.9 inches

Delpoint and similar soils

Composition: 25 percent

Geomorphic description: Hillside

Slope: 15 to 35 percent

Elevation: 5,000 to 6,200 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Loam

Rock fragments on the soil surface: 15 to 35 percent cobbles; 0.01 to 0.10 percent stones

Depth to restrictive feature: Bedrock (paralithic): 20 to 40 inches

Drainage class: Well drained

Parent material: Alluvium over residuum weathered from siltstone

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 4.5 inches

Geohrock and similar soils

Composition: 25 percent

Geomorphic description: Hillside

Slope: 15 to 35 percent

Elevation: 5,000 to 6,200 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Cobbly sandy loam

Drainage class: Well drained

Parent material: Gravelly alluvium

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 3.9 inches

Additional Components

Cabbart and similar soils: 3 percent
Kalsted and similar soils: 3 percent
Thess and similar soils: 3 percent
Sappington and similar soils: 2 percent
Udecide and similar soils: 2 percent
Bronec and similar soils: 1 percent
Rock outcrop: 1 percent

335E—Kalsted-Scravo, stony-Cabbart complex, 15 to 45 percent slopes

Map Unit Setting

Elevation: 4,900 to 6,000 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days

Component Description

Kalsted and similar soils

Composition: 35 percent
Geomorphic description: Escarpment and hill
Slope: 15 to 45 percent
Elevation: 4,900 to 6,000 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Gravelly sandy loam
Drainage class: Well drained
Parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 6.9 inches

Scravo and similar soils

Composition: 30 percent
Geomorphic description: Escarpment
Slope: 15 to 45 percent
Elevation: 4,900 to 6,000 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Gravelly sandy loam
Rock fragments on the soil surface: 0.01 to 0.10 percent stones
Drainage class: Well drained
Parent material: Sandy and gravelly alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.2 inches

Cabbart and similar soils

Composition: 15 percent
Geomorphic description: Escarpment
Slope: 15 to 45 percent
Elevation: 4,900 to 6,000 feet

Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Cobbly loam
Depth to restrictive feature: Bedrock (paralithic): 10 to 20 inches
Drainage class: Well drained
Parent material: Residuum weathered from calcareous siltstone
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.7 inches

Additional Components

Rock outcrop: 10 percent
Bronec and similar soils: 3 percent
Trudau and similar soils: 3 percent
Crago and similar soils: 2 percent
Kalsted, lesser slopes and similar soils: 2 percent

336D—Amesha-Bronec-Sappington complex, 4 to 15 percent slopes

Map Unit Setting

Elevation: 4,800 to 6,000 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days

Component Description

Amesha and similar soils

Composition: 35 percent
Geomorphic description: Alluvial fan
Slope: 4 to 15 percent
Elevation: 4,800 to 6,000 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Loam
Drainage class: Well drained
Parent material: Calcareous alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.3 inches

Bronec and similar soils

Composition: 30 percent
Geomorphic description: Alluvial fan
Slope: 8 to 15 percent
Elevation: 4,800 to 6,000 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Very cobbly sandy loam
Drainage class: Well drained
Parent material: Alluvium
Native plant cover type: Rangeland

Flooding: None
Available water capacity: Mainly 5.4 inches

Sappington and similar soils

Composition: 15 percent
Geomorphic description: Alluvial fan
Slope: 4 to 8 percent
Elevation: 4,800 to 6,000 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Loam
Drainage class: Well drained
Parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 8.3 inches

Additional Components

Geohrock and similar soils: 10 percent
Kalsted and similar soils: 10 percent

**372E—Rencot-Spudbar-Rock outcrop complex,
8 to 25 percent slopes****Map Unit Setting**

Elevation: 5,000 to 6,400 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days

Component Description**Rencot and similar soils**

Composition: 35 percent
Geomorphic description: Side slope on hill and interfluvium on hill
Slope: 8 to 25 percent
Elevation: 5,000 to 6,400 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Very cobbly loam
Depth to restrictive feature: Bedrock (lithic): 10 to 20 inches
Drainage class: Well drained
Parent material: Residuum weathered from tuff and/or residuum over sandstone, siltstone, or shale
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.4 inches

Spudbar and similar soils

Composition: 30 percent
Geomorphic description: Side slope on hill and interfluvium on hill
Slope: 8 to 25 percent
Elevation: 5,000 to 6,400 feet
Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Very cobbly loam

Depth to restrictive feature: Bedrock (lithic): 20 to 40 inches

Drainage class: Well drained

Parent material: Residuum over calcareous shale and/or calcareous siltstone and/or residuum weathered from tuff

Native plant cover type: Rangeland

Available water capacity: Mainly 2.1 inches

Rock outcrop

Composition: 15 percent

Additional Components

Amesha and similar soils: 5 percent

Zbart and similar soils: 5 percent

Spudbar, stony and similar soils: 4 percent

Bronec and similar soils: 3 percent

Rencot and similar soils: 3 percent

394E—Minestope-Beeftrail-Rock outcrop complex, 8 to 30 percent slopes

Map Unit Setting

Elevation: 5,220 to 6,300 feet

Mean annual precipitation: 13 to 17 inches

Frost-free period: 50 to 70 days

Component Description

Minestope and similar soils

Composition: 40 percent

Geomorphic description: Side slope on south-tending hill

Slope: 8 to 30 percent, east to west aspects

Elevation: 5,220 to 6,300 feet

Effective annual precipitation: 12 to 14 inches

Frost-free period: 50 to 70 days

Surface layer texture: Gravelly coarse sandy loam

Rock fragments on the soil surface: 0.10 to 3.00 percent stones, 10 to 40 feet apart

Depth to restrictive feature:

- *Bedrock (paralithic):* 10 to 20 inches

- *Bedrock (lithic):* 20 to 40 inches

Drainage class: Somewhat excessively drained

Parent material: Residuum weathered from granite

Flooding: None

Available water capacity: Mainly 1.3 inches

Beeftrail and similar soils

Composition: 30 percent

Geomorphic description: Side slope on south-tending hill

Slope: 8 to 30 percent, east to west aspects

Elevation: 5,220 to 6,300 feet

Effective annual precipitation: 12 to 14 inches

Frost-free period: 50 to 70 days

Surface layer texture: Gravelly coarse sandy loam

Rock fragments on the soil surface: 0.10 to 3.00 percent stones, 10 to 40 feet apart

Depth to restrictive feature:

- *Bedrock (paralithic):* 20 to 40 inches

- *Bedrock (lithic):* 28 to 56 inches

Drainage class: Somewhat excessively drained

Parent material: Residuum weathered from granite

Flooding: None

Available water capacity: Mainly 2.1 inches

Rock outcrop

Composition: 15 percent

Definition: Moderately to strongly indurated quartz monzonite of the Boulder Batholith

Minestope, forested and similar soils

Composition: 10 percent

Geomorphic description: Side slope on south-tending hill

Slope: 4 to 35 percent, east to west aspects

Elevation: 5,220 to 6,300 feet

Effective annual precipitation: 12 to 14 inches

Frost-free period: 50 to 70 days

Surface layer texture: Gravelly loamy coarse sand

Rock fragments on the soil surface: 0.10 to 3.00 percent stones, 10 to 40 feet apart

Depth to restrictive feature:

- *Bedrock (paralithic):* 10 to 20 inches

- *Bedrock (lithic):* 20 to 40 inches

Drainage class: Somewhat excessively drained

Parent material: Residuum weathered from granite

Native plant cover type: Forestland

Flooding: None

Available water capacity: Mainly 1.2 inches

Zonite, forested and similar soils

Composition: 5 percent

Geomorphic description: Nose slope on south-tending hill

Slope: 15 to 45 percent, east to west aspects

Elevation: 5,220 to 6,300 feet

Effective annual precipitation: 12 to 14 inches

Frost-free period: 50 to 70 days

Surface layer texture: Gravelly loamy coarse sand

Rock fragments on the soil surface: 3.00 to 10.00 percent stones, 7 to 10 feet apart

Depth to restrictive feature:

- *Bedrock (paralithic):* 4 to 10 inches

- *Bedrock (lithic):* 6 to 20 inches

Drainage class: Excessively drained

Parent material: Residuum weathered from granite

Native plant cover type: Forestland

Flooding: None

Available water capacity: Mainly 0.4 inches

433D—Varney-Udecide-Geohrock complex, 4 to 15 percent slopes

Map Unit Setting

Elevation: 5,000 to 6,200 feet

Mean annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Component Description

Varney and similar soils

Composition: 40 percent

Geomorphic description: Alluvial fan

Slope: 4 to 15 percent

Elevation: 5,000 to 6,200 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Sandy clay loam

Drainage class: Well drained

Parent material: Fine-loamy slope alluvium from semiconsolidated sandstone, siltstone, and shale

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 7.7 inches

Udecide and similar soils

Composition: 25 percent

Geomorphic description: Alluvial fan

Slope: 4 to 15 percent

Elevation: 5,000 to 6,200 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Sandy loam

Depth to restrictive feature: Bedrock (paralithic): 20 to 40 inches

Drainage class: Well drained

Parent material: Calcareous fine-loamy slope alluvium over residuum weathered from semiconsolidated sandstone-siltstone

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 4.5 inches

Geohrock and similar soils

Composition: 20 percent

Geomorphic description: Alluvial fan

Slope: 4 to 15 percent

Elevation: 5,000 to 6,200 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Gravelly sandy loam

Drainage class: Well drained

Parent material: Gravelly tertiary valley fill alluvium

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 4.1 inches

Additional Components

Cabbart and similar soils: 5 percent
Delpoint and similar soils: 5 percent
Sappington and similar soils: 5 percent

436D—Amesha-Haxby-Rencot complex, 4 to 15 percent slopes

Map Unit Setting

Elevation: 4,800 to 5,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days

Component Description

Amesha and similar soils

Composition: 45 percent
Geomorphic description: Alluvial fan
Slope: 4 to 15 percent
Elevation: 4,800 to 5,500 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Loam
Drainage class: Well drained
Parent material: Calcareous alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.3 inches

Haxby and similar soils

Composition: 25 percent
Geomorphic description: Alluvial fan
Slope: 4 to 15 percent
Elevation: 4,800 to 5,500 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Loam
Depth to restrictive feature: Bedrock (lithic): 20 to 40 inches
Drainage class: Well drained
Parent material: Alluvium over residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.4 inches

Rencot and similar soils

Composition: 15 percent
Geomorphic description: Hill
Slope: 4 to 15 percent
Elevation: 4,800 to 5,500 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Cobbly sandy loam
Depth to restrictive feature: Bedrock (lithic): 10 to 20 inches

Drainage class: Well drained
Parent material: Alluvium over residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.4 inches

Additional Components

Brocko and similar soils: 5 percent
Kalsted and similar soils: 3 percent
Rock outcrop: 3 percent
Bronec and similar soils: 2 percent
Spudbar and similar soils: 2 percent

533D—Varney-Kalsted, stony-Cabbart, stony complex, 4 to 15 percent slopes

Map Unit Setting

Elevation: 5,200 to 6,200 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days

Component Description

Varney and similar soils

Composition: 45 percent
Geomorphic description: Alluvial fan
Slope: 4 to 15 percent
Elevation: 5,200 to 6,200 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Sandy clay loam
Drainage class: Well drained
Parent material: Mixed alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 7.7 inches

Kalsted and similar soils

Composition: 20 percent
Geomorphic description: Hill
Slope: 4 to 15 percent
Elevation: 5,200 to 6,200 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Very cobbly sandy loam
Rock fragments on the soil surface: 0.01 to 0.10 percent stones
Drainage class: Well drained
Parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 6.9 inches

Cabbart and similar soils*Composition:* 15 percent*Geomorphic description:* Hillside*Slope:* 4 to 15 percent*Elevation:* 5,200 to 6,200 feet*Effective annual precipitation:* 10 to 14 inches*Frost-free period:* 90 to 105 days*Surface layer texture:* Very cobbly sandy loam*Rock fragments on the soil surface:* 0.01 to 0.10 percent stones*Depth to restrictive feature:* Bedrock (paralithic): 10 to 20 inches*Drainage class:* Well drained*Parent material:* Loamy residuum over calcareous shale and/or sandstone*Native plant cover type:* Rangeland*Flooding:* None*Available water capacity:* Mainly 2.6 inches**Additional Components**

Amesha and similar soils: 8 percent

Delpoint and similar soils: 6 percent

Thess and similar soils: 3 percent

Bronc and similar soils: 2 percent

Rock outcrop: 1 percent

**535D—Kalsted-Blacksheep-Rock outcrop complex,
4 to 15 percent slopes****Map Unit Setting***Elevation:* 4,800 to 6,000 feet*Mean annual precipitation:* 10 to 14 inches*Frost-free period:* 90 to 105 days**Component Description****Kalsted and similar soils***Composition:* 40 percent*Geomorphic description:* Alluvial fan*Slope:* 4 to 15 percent*Elevation:* 4,800 to 5,400 feet*Effective annual precipitation:* 10 to 14 inches*Frost-free period:* 90 to 105 days*Surface layer texture:* Sandy loam*Drainage class:* Well drained*Parent material:* Alluvium*Native plant cover type:* Rangeland*Flooding:* None*Available water capacity:* Mainly 6.9 inches**Additional Components**

Blacksheep and similar soils: 35 percent

Component Description**Rock outcrop***Composition:* 15 percent

Additional Components

Delpoint and similar soils: 3 percent
Pensore and similar soils: 3 percent
Haxby and similar soils: 2 percent
Rentsac and similar soils: 2 percent

537P—Elve-Gambler-Libeg families complex, moderately steep mountain slopes

Map Unit Setting

Elevation: 6,800 to 7,800 feet
Mean annual precipitation: 15 to 25 inches
Frost-free period: 30 to 60 days

Component Description

Elve and similar soils

Composition: 30 percent
Geomorphic description: Mountain slope
Slope: 20 to 45 percent
Elevation: 6,800 to 7,800 feet
Effective annual precipitation: 15 to 25 inches
Frost-free period: 30 to 60 days
Surface layer texture: Gravelly sandy loam
Drainage class: Somewhat excessively drained
Parent material: Colluvium and/or residuum derived from quartzite
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 4.7 inches

Gambler and similar soils

Composition: 30 percent
Geomorphic description: Mountain slope
Slope: 20 to 45 percent
Elevation: 6,800 to 7,800 feet
Effective annual precipitation: 15 to 25 inches
Frost-free period: 30 to 60 days
Surface layer texture: Loam
Drainage class: Well drained
Parent material: Colluvium and/or residuum derived from quartzite
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 6.1 inches

Libeg and similar soils

Composition: 20 percent
Geomorphic description: Mountain slope
Slope: 20 to 45 percent
Elevation: 6,800 to 7,800 feet
Effective annual precipitation: 15 to 25 inches
Frost-free period: 30 to 60 days
Surface layer texture: Stony loam
Drainage class: Well drained

Parent material: Colluvium and/or residuum derived from quartzite

Native plant cover type: Forestland

Flooding: None

Available water capacity: Mainly 5.0 inches

Additional Components

Loberg and similar soils: 10 percent

Sebud and similar soils: 10 percent

541D—Whitlash, very stony-Brickner, stony-Rock outcrop complex, 4 to 25 percent slopes

Map Unit Setting

Elevation: 5,500 to 6,500 feet

Mean annual precipitation: 15 to 19 inches

Frost-free period: 70 to 90 days

Component Description

Whitlash and similar soils

Composition: 40 percent

Geomorphic description: Escarpment, hillside, and ridge

Slope: 4 to 25 percent

Elevation: 5,500 to 6,200 feet

Effective annual precipitation: 15 to 19 inches

Frost-free period: 70 to 90 days

Surface layer texture: Very cobbly coarse sandy loam

Rock fragments on the soil surface: 0.10 to 3.00 percent stones

Depth to restrictive feature: Bedrock (lithic): 10 to 20 inches

Drainage class: Well drained

Parent material: Gravelly residuum weathered from fine-grained sandstone

Native plant cover type: Forestland

Flooding: None

Available water capacity: Mainly 0.9 inches

Brickner and similar soils

Composition: 30 percent

Geomorphic description: Escarpment, hillside, and ridge

Slope: 4 to 25 percent

Elevation: 5,500 to 6,200 feet

Effective annual precipitation: 15 to 19 inches

Frost-free period: 70 to 90 days

Surface layer texture: Gravelly sandy clay loam

Rock fragments on the soil surface: 0.01 to 0.10 percent stones

Depth to restrictive feature: Bedrock (lithic): 10 to 20 inches

Drainage class: Well drained

Parent material: Gravelly residuum weathered from basalt

Native plant cover type: Forestland

Flooding: None

Available water capacity: Mainly 1.1 inches

Rock outcrop (sandstone)

Composition: 20 percent

Definition: Rock outcrop consist mainly of exposed areas of hard, sedimentary, and metamorphic bedrock. Angular cobbles, stones, and boulders litter the area and accumulate at the base of hills and escarpments.

Additional Components

Perma and similar soils: 5 percent

Wickes and similar soils: 5 percent

547P—Gambler-Elve-Sebud families complex, steep mountain slopes**Map Unit Setting**

Elevation: 6,400 to 8,200 feet

Mean annual precipitation: 15 to 25 inches

Frost-free period: 30 to 60 days

Component Description**Elve and similar soils**

Composition: 30 percent

Geomorphic description: Mountain slope

Slope: 45 to 70 percent

Elevation: 6,400 to 8,200 feet

Effective annual precipitation: 15 to 25 inches

Frost-free period: 30 to 60 days

Surface layer texture: Very gravelly loam

Depth to restrictive feature: None noted

Drainage class: Somewhat excessively drained

Parent material: Colluvium derived from quartzite

Native plant cover type: Forestland

Flooding: None

Available water capacity: Mainly 4.6 inches

Gambler and similar soils

Composition: 30 percent

Geomorphic description: Mountain slope

Slope: 45 to 70 percent

Elevation: 6,400 to 8,200 feet

Effective annual precipitation: 15 to 25 inches

Frost-free period: 30 to 60 days

Surface layer texture: Loam

Depth to restrictive feature: None noted

Drainage class: Well drained

Parent material: Colluvium derived from quartzite

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 6.1 inches

Sebud and similar soils

Composition: 20 percent

Geomorphic description: Mountain slope

Slope: 45 to 70 percent
Elevation: 6,400 to 8,200 feet
Effective annual precipitation: 15 to 25 inches
Frost-free period: 30 to 60 days
Surface layer texture: Stony loam
Depth to restrictive feature: None noted
Drainage class: Well drained
Parent material: Colluvium derived from quartzite
Native plant cover type: Forestland
Flooding: None
Available water capacity: Mainly 3.9 inches

Additional Components

Libeg and similar soils: 10 percent
Rock outcrop: 10 percent

586B—Rominell loam, 0 to 4 percent slopes**Map Unit Setting**

Elevation: 4,800 to 5,200 feet
Mean annual precipitation: 10 to 12 inches
Frost-free period: 90 to 105 days

Component Description**Rominell and similar soils**

Composition: 90 percent
Geomorphic description: Alluvial fan and tread on terrace
Slope: 0 to 4 percent
Elevation: 4,800 to 5,200 feet
Effective annual precipitation: 10 to 12 inches
Frost-free period: 90 to 105 days
Surface layer texture: Loam
Drainage class: Well drained
Parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 8.6 inches

Additional Components

Trudau and similar soils: 8 percent
Varney and similar soils: 2 percent

**627C—Bronec-Kalsted gravelly sandy loams,
2 to 8 percent slopes**

Elevation: 5,000 to 6,200 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days

Component Description

Bronec and similar soils

Composition: 55 percent
Geomorphic description: Alluvial fan
Slope: 2 to 8 percent
Elevation: 5,000 to 6,200 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Gravelly sandy loam
Drainage class: Well drained
Parent material: Calcareous alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.6 inches

Kalsted and similar soils

Composition: 30 percent
Geomorphic description: Alluvial fan
Slope: 2 to 8 percent
Elevation: 5,000 to 6,200 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Gravelly sandy loam
Drainage class: Well drained
Parent material: Calcareous alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 6.9 inches

Additional Components

Amesha and similar soils: 8 percent
Bronec, stony and similar soils: 4 percent
Bronec, greater slopes and similar soils: 2 percent
Kalsted and similar soils: 1 percent

627D—Bronec-Kalsted complex, 4 to 15 percent slopes

Map Unit Setting

Elevation: 5,000 to 6,200 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days

Component Description

Bronec and similar soils

Composition: 50 percent
Geomorphic description: Alluvial fan
Slope: 4 to 15 percent
Elevation: 5,000 to 6,200 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Very gravelly sandy loam
Drainage class: Well drained

Parent material: Mixed calcareous alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.4 inches

Kalsted and similar soils

Composition: 30 percent
Geomorphic description: Alluvial fan
Slope: 4 to 15 percent
Elevation: 5,000 to 6,200 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Gravelly sandy loam
Drainage class: Well drained
Parent material: Mixed calcareous alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 6.9 inches

Additional Components

Amesha and similar soils: 8 percent
 Bronec, stony and similar soils: 5 percent
 Bronec, very stony and similar soils: 3 percent
 Bronec, greater slopes and similar soils: 2 percent
 Trimad and similar soils: 2 percent

927E—Bronec-Trimad-Kalsted complex, 15 to 45 percent slopes

Map Unit Setting

Elevation: 4,800 to 5,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days

Component Description

Bronec and similar soils

Composition: 40 percent
Geomorphic description: Hillside
Slope: 15 to 45 percent
Elevation: 4,800 to 5,500 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Very cobbly sandy loam
Drainage class: Well drained
Parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.4 inches

Trimad and similar soils

Composition: 30 percent
Geomorphic description: North-facing hillside and swales on hillside

Slope: 15 to 45 percent
Elevation: 4,800 to 5,500 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Cobbly loam
Drainage class: Well drained
Parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.1 inches

Kalsted and similar soils

Composition: 15 percent
Geomorphic description: Hillside
Slope: 15 to 45 percent
Elevation: 4,800 to 5,500 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Gravelly sandy loam
Drainage class: Well drained
Parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 6.9 inches

Additional Components

Geohrock and similar soils: 5 percent
 Scravo, very stony and similar soils: 3 percent
 Bronec, lesser slopes and similar soils: 2 percent
 Kalsted, lesser slopes and similar soils: 2 percent
 Scravo and similar soils: 2 percent
 Rubble land: 1 percent

998E—Libeg-Nieman, stony complex, 8 to 25 percent slopes

Map Unit Setting

Elevation: 5,500 to 8,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 30 to 70 days

Component Description

Libeg and similar soils

Composition: 55 percent
Geomorphic description: Mountain slope
Slope: 8 to 25 percent
Elevation: 5,500 to 7,500 feet
Effective annual precipitation: 15 to 19 inches
Frost-free period: 30 to 70 days
Surface layer texture: Gravelly loam
Drainage class: Well drained
Parent material: Gravelly till, unspecified

Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.5 inches

Nieman and similar soils

Composition: 30 percent
Geomorphic description: Mountaintop on mountain slope and ridge
Slope: 8 to 25 percent
Elevation: 5,500 to 7,000 feet
Effective annual precipitation: 15 to 19 inches
Frost-free period: 30 to 70 days
Surface layer texture: Cobbly loam
Rock fragments on the soil surface: 0.01 to 0.10 percent stones
Depth to restrictive feature: Bedrock (lithic): 10 to 20 inches
Drainage class: Well drained
Parent material: Gravelly residuum weathered from basalt
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.2 inches

Additional Components

Rock outcrop: 5 percent
 Sebud and similar soils: 4 percent
 Poin and similar soils: 3 percent
 Surdal and similar soils: 3 percent

**999E—Ermont-Rock outcrop-Ratiopeak complex,
 4 to 35 percent slopes**

Map Unit Setting

Elevation: 6,000 to 7,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 30 to 70 days

Component Description

Ermont and similar soils

Composition: 75 percent
Geomorphic description: Summit on hill and shoulder on hill
Slope: 4 to 35 percent
Elevation: 6,000 to 7,000 feet
Effective annual precipitation: 15 to 19 inches
Frost-free period: 30 to 70 days
Surface layer texture: Gravelly loam
Rock fragments on the soil surface: 0.01 to 0.10 percent stones
Depth to restrictive feature: Bedrock (lithic): 10 to 20 inches
Drainage class: Well drained
Parent material: Gravelly residuum weathered from welded tuff
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.9 inches

Additional Components

Rock outcrop: 15 percent

Ratiopeak and similar soils: 10 percent

1003E—Tiban, bouldery-Cheadle, very bouldery complex, 15 to 35 percent slopes

Map Unit Setting

Elevation: 5,500 to 7,500 feet

Mean annual precipitation: 15 to 24 inches

Frost-free period: 30 to 70 days

Component Description

Tiban and similar soils

Composition: 50 percent

Geomorphic description: Alluvial fan and mountainbase on mountain slope

Slope: 15 to 35 percent

Elevation: 5,500 to 7,000 feet

Effective annual precipitation: 15 to 24 inches

Frost-free period: 30 to 70 days

Surface layer texture: Gravelly loam

Rock fragments on the soil surface: 0.01 to 0.10 percent boulders

Drainage class: Well drained

Parent material: Gravelly slope alluvium derived from basalt

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 5.8 inches

Cheadle and similar soils

Composition: 30 percent

Geomorphic description: Mountain slope and ridge

Slope: 15 to 35 percent

Elevation: 5,500 to 7,000 feet

Effective annual precipitation: 15 to 24 inches

Frost-free period: 30 to 70 days

Surface layer texture: Very gravelly loam

Rock fragments on the soil surface: 0.10 to 3.00 percent boulders

Depth to restrictive feature: Bedrock (lithic): 10 to 20 inches

Drainage class: Well drained

Parent material: Gravelly residuum weathered from basalt

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 1.6 inches

Additional Components

Nieman and similar soils: 4 percent

Ratiopeak and similar soils: 4 percent

Kimpton and similar soils: 3 percent

Sebud and similar soils: 3 percent

Surdal and similar soils: 3 percent

Tibkey and similar soils: 3 percent

1690F—Cheadle, very stony-Rock outcrop-Tiban, bouldery complex, 15 to 45 percent slopes

Map Unit Setting

Elevation: 5,500 to 7,000 feet

Mean annual precipitation: 15 to 19 inches

Frost-free period: 30 to 70 days

Component Description

Cheadle and similar soils

Composition: 40 percent

Geomorphic description: Mountain slope and ridge

Slope: 15 to 45 percent

Elevation: 5,500 to 7,000 feet

Effective annual precipitation: 15 to 19 inches

Frost-free period: 30 to 70 days

Surface layer texture: Very gravelly loam

Rock fragments on the soil surface: 0.10 to 3.00 percent stones

Depth to restrictive feature: Bedrock (lithic): 10 to 20 inches

Drainage class: Well drained

Parent material: Gravelly residuum weathered from basalt

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 1.6 inches

Rock outcrop (sandstone)

Composition: 25 percent

Definition: Rock outcrop consist mainly of exposed areas of hard, sedimentary, and metamorphic bedrock. Angular cobbles, stones, and boulders litter the area and accumulate at the base of hills and escarpments.

Tiban and similar soils

Composition: 20 percent

Geomorphic description: Hillside

Slope: 15 to 45 percent

Elevation: 5,500 to 7,000 feet

Effective annual precipitation: 15 to 19 inches

Frost-free period: 30 to 70 days

Surface layer texture: Gravelly loam

Rock fragments on the soil surface: 0.01 to 0.10 percent boulders

Drainage class: Well drained

Parent material: Gravelly slope alluvium derived from basalt

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 5.8 inches

Additional Components

Kimpton and similar soils: 6 percent

Philipsburg and similar soils: 5 percent

Ratiopeak and similar soils: 4 percent

2125F—Rubble land-Elve, very stony-Rock outcrop complex, 25 to 60 percent slopes**Map Unit Setting**

Elevation: 5,500 to 7,000 feet

Mean annual precipitation: 15 to 24 inches

Frost-free period: 50 to 70 days

Component Description**Rubble land (volcanic)**

Composition: 60 percent

Definition: This component consists of extensive areas of hard, fine-grained, angular volcanic cobbles, stones, and boulders.

Elve and similar soils

Composition: 25 percent

Geomorphic description: Mountainflank on mountain slope

Slope: 25 to 60 percent

Elevation: 5,500 to 7,000 feet

Effective annual precipitation: 15 to 24 inches

Frost-free period: 50 to 70 days

Surface layer texture: Very cobbly loam

Rock fragments on the soil surface: 0.10 to 3.00 percent stones

Drainage class: Somewhat excessively drained

Parent material: Gravelly colluvium derived from basalt

Native plant cover type: Forestland

Available water capacity: Mainly 2.0 inches

Rock outcrop (volcanic)

Composition: 15 percent

Definition: This component consists mainly of exposed areas of hard, fractured, fine-grained volcanic extrusive bedrock.

2213E—Sebud, stony-Surdal, stony-Poin, very stony complex, 8 to 35 percent slopes**Map Unit Setting**

Elevation: 5,500 to 7,000 feet

Mean annual precipitation: 15 to 24 inches

Frost-free period: 30 to 70 days

Component Description**Sebud and similar soils**

Composition: 55 percent

Geomorphic description: Alluvial fan and mountain slope

Slope: 8 to 35 percent

Elevation: 5,500 to 7,000 feet

Effective annual precipitation: 15 to 24 inches

Frost-free period: 30 to 70 days

Surface layer texture: Very gravelly loam

Rock fragments on the soil surface: 0.01 to 0.10 percent stones

Drainage class: Well drained
Parent material: Gravelly slope alluvium derived from basalt
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.6 inches

Surdal and similar soils

Composition: 20 percent
Geomorphic description: Mountain slope and ridge
Slope: 8 to 35 percent
Elevation: 5,500 to 7,000 feet
Effective annual precipitation: 15 to 24 inches
Frost-free period: 30 to 70 days
Surface layer texture: Very gravelly loam
Rock fragments on the soil surface: 0.01 to 0.10 percent stones
Depth to restrictive feature: Bedrock (lithic): 20 to 40 inches
Drainage class: Well drained
Parent material: Gravelly slope alluvium over residuum derived from basalt
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.1 inches

Poin and similar soils

Composition: 15 percent
Geomorphic description: Mountain slope and ridge
Slope: 8 to 35 percent
Elevation: 5,500 to 7,000 feet
Effective annual precipitation: 15 to 24 inches
Frost-free period: 30 to 70 days
Surface layer texture: Very cobbly loam
Rock fragments on the soil surface: 0.10 to 3.00 percent stones
Depth to restrictive feature: Bedrock (lithic): 10 to 20 inches
Drainage class: Well drained
Parent material: Gravelly residuum weathered from basalt
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.4 inches

Additional Components

Libeg and similar soils: 3 percent
 Tibkey and similar soils: 3 percent
 Elve and similar soils: 2 percent
 Rock outcrop (volcanic): 2 percent

2712D—Libeg-Mooseflat loams, 4 to 25 percent slopes

Map Unit Setting

Elevation: 5,500 to 7,500 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 30 to 70 days

Component Description

Libeg and similar soils

Composition: 60 percent
Geomorphic description: Hillside
Slope: 4 to 25 percent
Elevation: 5,500 to 7,500 feet
Effective annual precipitation: 15 to 19 inches
Frost-free period: 30 to 70 days
Surface layer texture: Loam
Drainage class: Well drained
Parent material: Gravelly till, unspecified
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.5 inches

Mooseflat and similar soils

Composition: 25 percent
Geomorphic description: Flood plain
Slope: 4 to 8 percent
Elevation: 5,500 to 7,500 feet
Effective annual precipitation: 15 to 19 inches
Frost-free period: 30 to 70 days
Surface layer texture: Loam
Drainage class: Very poorly drained
Parent material: Organic material over fine-loamy alluvium over sandy and gravelly alluvium
Native plant cover type: Rangeland
Flooding: Frequent
Water table: Present
Available water capacity: Mainly 4.4 inches

Additional Components

Libeg and similar soils: 10 percent
Tibkey and similar soils: 4 percent
Water: 1 percent

9100F—Blackleaf, stony-Twinadams, very stony-Rock outcrop complex, 20 to 60 percent slopes

Map Unit Setting

Elevation: 5,500 to 6,500 feet
Mean annual precipitation: 10 to 14 inches
Frost-free period: 70 to 90 days

Component Description

Blackleaf and similar soils

Composition: 35 percent
Geomorphic description: Strike ridge
Slope: 20 to 60 percent
Elevation: 5,500 to 6,500 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 70 to 90 days

Surface layer texture: Very channery sandy loam

Rock fragments on the soil surface: 0.01 to 0.10 percent stones

Depth to restrictive feature: Bedrock (lithic): 10 to 20 inches

Drainage class: Well drained

Parent material: Residuum over sandstone and/or siltstone and/or shale

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 1.1 inches

Twinadams and similar soils

Composition: 30 percent

Geomorphic description: Strike ridge

Slope: 20 to 60 percent

Elevation: 5,500 to 6,500 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 70 to 90 days

Surface layer texture: Very channery loam

Rock fragments on the soil surface: 0.10 to 3.00 percent stones

Depth to restrictive feature:

- *Bedrock (paralithic):* 20 to 36 inches
- *Bedrock (lithic):* 30 to 40 inches

Drainage class: Well drained

Parent material: Residuum over sandstone and/or siltstone and/or shale

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 2.1 inches

Rock outcrop

Composition: 15 percent

Additional Components

Twinadams, bouldery and similar soils: 8 percent

Component Description

Pensore and similar soils

Composition: 4 percent

Geomorphic description: Hill

Slope: 4 to 45 percent

Elevation: 5,500 to 6,500 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 70 to 90 days

Surface layer texture: Channery loam

Depth to restrictive feature: Bedrock (lithic): 10 to 20 inches

Drainage class: Well drained

Parent material: Residuum weathered from limestone

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 1.3 inches

Additional Components

Rencot and similar soils: 3 percent

Spudbar and similar soils: 3 percent

Cabbart and similar soils: 2 percent

9101E—Twinadams-Thunderhead-Blackleaf, stony complex, 8 to 25 percent slopes

Map Unit Setting

Elevation: 5,500 to 6,500 feet

Mean annual precipitation: 10 to 14 inches

Frost-free period: 70 to 90 days

Component Description

Twinadams and similar soils

Composition: 30 percent

Geomorphic description: Strike ridge

Slope: 8 to 25 percent

Elevation: 5,500 to 6,500 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 70 to 90 days

Surface layer texture: Very channery loam

Depth to restrictive feature:

- *Bedrock (paralithic):* 20 to 36 inches
- *Bedrock (lithic):* 30 to 40 inches

Drainage class: Well drained

Parent material: Residuum over sandstone and/or siltstone and/or shale

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 2.1 inches

Thunderhead and similar soils

Composition: 25 percent

Geomorphic description: Strike ridge

Slope: 8 to 15 percent

Elevation: 5,500 to 6,500 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 70 to 90 days

Surface layer texture: Gravelly loam

Depth to restrictive feature:

- *Bedrock (paralithic):* 22 to 40 inches
- *Bedrock (lithic):* 25 to 40 inches

Drainage class: Well drained

Parent material: Residuum over sandstone and/or siltstone and/or shale

Available water capacity: Mainly 4.0 inches

Blackleaf and similar soils

Composition: 20 percent

Geomorphic description: Strike ridge

Slope: 8 to 25 percent

Elevation: 5,500 to 6,500 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 70 to 90 days

Surface layer texture: Very channery sandy loam

Rock fragments on the soil surface: 0.01 to 0.10 percent stones

Depth to restrictive feature: Bedrock (lithic): 10 to 20 inches

Drainage class: Well drained

Parent material: Residuum over sandstone and/or siltstone and/or shale

Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.1 inches

Additional Components

Haxby and similar soils: 7 percent
Spudbar and similar soils: 6 percent
Geohrock and similar soils: 5 percent
Rock outcrop: 4 percent
Sappington and similar soils: 3 percent

9102F—Nathale, very bouldery-Poin, very flaggy-Rock outcrop complex, 20 to 60 percent slopes

Map Unit Setting

Elevation: 6,000 to 7,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 30 to 70 days

Component Description

Nathale and similar soils

Composition: 40 percent
Geomorphic description: Strike ridge
Slope: 20 to 60 percent
Elevation: 6,000 to 7,000 feet
Effective annual precipitation: 15 to 19 inches
Frost-free period: 30 to 70 days
Surface layer texture: Very channery sandy clay loam
Rock fragments on the soil surface: 0.10 to 3.00 percent boulders
Depth to restrictive feature: Bedrock (lithic): 20 to 40 inches
Drainage class: Well drained
Parent material: Residuum over sandstone and/or siltstone and/or shale
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.5 inches

Poin and similar soils

Composition: 30 percent
Geomorphic description: Strike ridge
Slope: 20 to 60 percent
Elevation: 6,000 to 7,000 feet
Effective annual precipitation: 15 to 19 inches
Frost-free period: 30 to 70 days
Surface layer texture: Very channery loam
Rock fragments on the soil surface: 0.10 to 3.00 percent stones
Depth to restrictive feature: Bedrock (lithic): 10 to 20 inches
Drainage class: Well drained
Parent material: Residuum over sandstone and/or siltstone and/or shale
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.4 inches

Rock outcrop

Composition: 20 percent

Additional Components

Cheadle and similar soils: 3 percent

Ratiopeak and similar soils: 3 percent

Hanson and similar soils: 2 percent

Surdal and similar soils: 2 percent

**9103D—Faith-Geohrock, stony-Beavrock complex,
2 to 15 percent slopes****Map Unit Setting**

Elevation: 5,500 to 6,500 feet

Mean annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Component Description**Faith and similar soils**

Composition: 35 percent

Geomorphic description: Flood plain and stream terrace

Slope: 2 to 8 percent

Elevation: 5,500 to 6,500 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Silt loam

Drainage class: Moderately well drained

Parent material: Alluvium

Native plant cover type: Rangeland

Flooding: Rare

Water table: Present

Available water capacity: Mainly 10.1 inches

Geohrock and similar soils

Composition: 25 percent

Geomorphic description: Alluvial fan

Slope: 8 to 15 percent

Elevation: 5,500 to 6,500 feet

Effective annual precipitation: 10 to 14 inches

Frost-free period: 90 to 105 days

Surface layer texture: Very cobbly loam

Rock fragments on the soil surface: 0.01 to 0.10 percent stones

Drainage class: Well drained

Parent material: Alluvium

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 3.9 inches

Beavrock and similar soils

Composition: 20 percent

Geomorphic description: Flood plain

Slope: 2 to 4 percent

Elevation: 5,500 to 6,500 feet
Effective annual precipitation: 10 to 14 inches
Frost-free period: 90 to 105 days
Surface layer texture: Silt loam
Drainage class: Poorly drained
Parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Occasional
Water table: Present
Available water capacity: Mainly 5.4 inches

Additional Components

Bronec and similar soils: 4 percent
 Dillon and similar soils: 4 percent
 Glendive and similar soils: 3 percent
 Geohrock, bouldery and similar soils: 2 percent
 Rivra and similar soils: 2 percent
 Sappington and similar soils: 2 percent
 Threeriv and similar soils: 2 percent
 Water: 1 percent

9105F—Ratiopeak, bouldery-Poin, flaggy complex, 15 to 45 percent slopes

Map Unit Setting

Elevation: 6,000 to 7,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 30 to 70 days

Component Description

Ratiopeak and similar soils

Composition: 50 percent
Geomorphic description: Footslope on hill
Slope: 15 to 45 percent
Elevation: 6,000 to 7,000 feet
Effective annual precipitation: 15 to 19 inches
Frost-free period: 30 to 70 days
Surface layer texture: Very cobbly loam
Rock fragments on the soil surface: 0.01 to 0.10 percent boulders
Drainage class: Well drained
Parent material: Residuum over sandstone and/or siltstone and/or shale
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.2 inches

Poin and similar soils

Composition: 20 percent
Geomorphic description: Hillside
Slope: 15 to 45 percent
Elevation: 6,000 to 7,000 feet
Effective annual precipitation: 15 to 19 inches
Frost-free period: 30 to 70 days

Surface layer texture: Very channery loam
Rock fragments on the soil surface: 0.01 to 0.10 percent stones
Depth to restrictive feature: Bedrock (lithic): 10 to 20 inches
Drainage class: Well drained
Parent material: Residuum weathered from sandstone and shale
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.4 inches

Additional Components

Nathale and similar soils: 5 percent
Philipsburg and similar soils: 5 percent
Ratiopeak, lesser slopes and similar soils: 5 percent
Rock outcrop: 5 percent
Cheadle and similar soils: 4 percent
Hanson and similar soils: 3 percent
Tiban and similar soils: 3 percent

DA—Denied access

Map Unit Setting

Denied access: 100 percent

GP—Gravel pits

Map Unit Setting

Gravel pits: 100 percent

M-W—Miscellaneous water

Map Unit Setting

Miscellaneous water: 100 percent

W—Water

Map Unit Setting

Water: 100 percent

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help to prevent soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavioral characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland and forestland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreational facilities; for agricultural waste management; and as wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, camp areas, playgrounds, lawns, and trees and shrubs.

Interpretive Ratings

The interpretive tables in this survey rate the soils in the survey area for various uses. Many of the tables identify the limitations that affect specified uses and indicate the severity of those limitations. The ratings in these tables are both verbal and numerical.

Rating Class Terms

Rating classes are expressed in the tables in terms that indicate the extent to which the soils are limited by all of the soil features that affect a specified use or in terms that indicate the suitability of the soils for the use. Thus, the tables may show limitation classes or suitability classes. Terms for the limitation classes are *not limited*, *somewhat limited*, and *very limited*. The suitability ratings are expressed as *well suited*, *moderately suited*, *poorly suited*, and *unsuited* or as *good*, *fair*, and *poor*.

Numerical Ratings

Numerical ratings in the tables indicate the relative severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.00 to 1.00.

They indicate gradations between the point at which a soil feature has the greatest negative impact on the use and the point at which the soil feature is not a limitation. The limitations appear in order from the most limiting to the least limiting. Thus, if more than one limitation is identified, the most severe limitation is listed first and the least severe one is listed last.

Agronomy

Crops and Pasture

General management needed for crops and pasture is suggested in this section. The estimated yields of the main crops and pasture plants are listed, the system of land capability classification used by the Natural Resources Conservation Service is explained, and prime farmland is described.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under the heading "Detailed Soil Map Units." Specific information can be obtained from the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

The Dillon Area—Part of Beaverhead County soil survey contains about 63,435 acres of cropland. The cropland is mostly irrigated with the exception of a few sections in the eastern part of Beaverhead County. The main crops are spring wheat, barley, oats, alfalfa, and a legume-grass mixture or grass used for hay and pasture.

Dryland-farming yields generally can be maintained or improved by reducing erosion, increasing soil organic matter, controlling weeds and insects, fertilizing, and avoiding excess tillage.

The main concerns on irrigated cropland are employing proper irrigation water management, controlling weeds, fertilizing, and selecting adapted crop varieties. Proper irrigation water management, which involves applying water at the optimum time and in adequate amounts, would reduce overirrigation, loss of nutrients, and short stand life. This management technique also helps to maintain higher production levels.

Wet soils are mainly used for hay production and pasture. Garrison creeping meadow foxtail produces excellent forage under these conditions.

Little dryland farming is undertaken because of the short growing season and marginal growing-season rainfall. Irrigation in this area is applied primarily by surface flooding methods. Forage production is used mainly to support the large number of cattle in the valley.

Pasture and hayland areas could be improved by reestablishing the desired grasses and legumes. Reestablishment is generally done by growing small grains for several years, then planting the area back to permanent cover for 5 to 12 years. Weed control and proper grazing also help insure that desired plant species are maintained.

Subirrigated meadows are used for wintering cattle and for early spring grazing. These areas are primarily native grasses or Garrison creeping meadow foxtail. Deteriorated stands may be reestablished or renovated by proper grazing, fertilization, or establishment of early season pasture such as crested wheatgrass.

Cropland Management

Management concerns affecting the use of the detailed soil map units in the survey area for constructing grassed waterways, vegetating grassed waterways and

filter strips, and installing sprinkler irrigation are shown in the table, “Cropland Management.”

A *grassed waterway* is a natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. The grassed waterway conducts surface water away from cropland.

A *filter strip* is a trench with a sand or gravel bottom used to filter water.

Sprinkler irrigation is a method to apply water to soils to assist in the production of crops. Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for forestland, or for engineering purposes.

In the capability system, soils are generally grouped at three levels—capability class, subclass, and unit (USDA, 1961)

Capability classes, the broadest groups, are designated by the numbers 1 through 8. The numbers indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class 1 soils have slight limitations that restrict their use.

Class 2 soils have moderate limitations that restrict the choice of plants or that require moderate conservation practices.

Class 3 soils have severe limitations that restrict the choice of plants or that require special conservation practices, or both.

Class 4 soils have very severe limitations that restrict the choice of plants or that require very careful management, or both.

Class 5 soils are subject to little or no erosion but have other limitations, impractical to remove, that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.

Class 6 soils have severe limitations that make them generally unsuitable for cultivation and that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.

Class 7 soils have very severe limitations that make them unsuitable for cultivation and that restrict their use mainly to grazing, forestland, or wildlife habitat.

Class 8 soils and miscellaneous areas have limitations that preclude commercial plant production and that restrict their use to recreational purposes, wildlife habitat, watershed, or esthetic purposes.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, 2*e*. The letter *e* shows that the main hazard is the risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class 1, there are no subclasses because the soils of this class have few limitations. Class 5 contains only the subclasses indicated by *w*, *s*, or *c* because the

soils in class 5 are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, forestland, wildlife habitat, or recreation.

The acreage of soils in each capability class or subclass is shown in the table, "Land Capability and Yields per Acre of Crops and Pasture." The capability classification of map units in this survey area is given in the section "Detailed Soil Map Units" and in the yields table.

Prime Farmland and Other Important Farmland

In this section, prime farmland and other important farmland are defined. The soils in the survey area that are considered prime farmland are listed in the table, "Prime and Important Farmland," at the end of this section.

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high-quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses. It could be cultivated land, pastureland, forestland, or other land, but it is not urban or built-up land or water areas. The soil qualities, growing season, and moisture supply are those needed for the soil to economically produce sustained high yields of crops when proper management, including water management, and acceptable farming methods are applied. In general, prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, an acceptable salt and sodium content, and few or no rocks. It is permeable to water and air. It is not excessively erodible or saturated with water for long periods, and it either is not frequently flooded during the growing season or is protected from flooding. Slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Natural Resources Conservation Service.

A recent trend in land use in some parts of the survey area has been the loss of some prime farmland to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, and less productive and cannot be easily cultivated.

About 53,050 acres, or nearly 15 percent of the survey area, would meet the requirements for prime farmland if an adequate and dependable supply of irrigation water was available.

The map units in the survey area that are considered prime farmland are listed in the "Prime and Important Farmland" table. This list does not constitute a recommendation for a particular land use. On some soils included in the list, measures that overcome a hazard or limitation, such as flooding, wetness, and droughtiness, are needed. The need for these measures is indicated after the map unit name. Onsite evaluation is needed to determine whether or not the hazard or limitation has been overcome by corrective measures. The extent of each listed map unit is shown in the "Acreage and Proportionate Extent of the Soils" table. The location is shown on the detailed soil maps. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

Additional Farmland of Statewide Importance

Some areas other than areas of prime farmland are of statewide importance in the production of food, feed, fiber, forage, and oilseed crops. The criteria used in defining and delineating these areas are determined by the appropriate state agency or agencies. Generally, additional farmland of statewide importance includes areas that nearly meet the criteria for prime farmland and that economically produce high yields of crops when treated and managed by acceptable farming methods. Some areas can produce as high a yield as areas of prime farmland if conditions are favorable. In some states, additional farmland of statewide importance may include tracts of land that have been designated for agriculture by state law.

Farmland of statewide importance is included in the list of prime farmland. Criteria are available in the Field Office Technical Guide, Section II, which is available in local offices of the Natural Resources Conservation Service and online at <http://www.nrcs.usda.gov/technical/efotg/>.

Rangeland

In areas that have similar climate and topography, differences in the kind and amount of rangeland or forest understory vegetation produced on rangeland are closely related to the kind of soil. Effective management is based on the relationship between the soils and vegetation and water.

Range is defined as land on which the native vegetation (the climax, or natural potential, plant community) is predominantly grasses, grasslike plants, forbs, and shrubs suitable for grazing and browsing. Range includes natural grasslands, savannas, many wetlands, some deserts, tundra, and certain shrub and forb communities. Range receives no regular or frequent cultural treatment. The composition and production of the plant community are determined by soil, climate, topography, overstory canopy, and grazing management.

Grazed forestland is defined as land on which the understory includes, as an integral part of the forest plant community, plants that can be grazed without significant impairment of other forest values.

Naturalized pasture is defined as forestland that is used primarily for the production of forage for grazing by livestock rather than for the production of wood products. Overstory trees are removed or managed to promote the native and introduced understory vegetation occurring on the site. This vegetation is managed for its forage value through the use of grazing management principles.

The table “Rangeland and Forest Understory Production and Plant Composition” at the end of this section shows, for each soil that supports vegetation suitable for grazing, the ecological site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic native vegetation; and the average percentage of each species. Explanation of the column headings in this table follows.

An *ecological site* is the product of all the environmental factors responsible for its development. It has characteristic soils that have developed over time throughout the soil development process; a characteristic hydrology, particularly infiltration and runoff, that has developed over time; and a characteristic plant community (kind and amount of vegetation). The hydrology of the site is influenced by development of the soil and plant community. The vegetation, soils, and hydrology are all interrelated. Each is influenced by the others and influences the development of the others. The plant community on an ecological site is typified by an association of species that differs from that of other ecological sites in the kind and/or proportion of species or in total production. Descriptions of ecological sites are provided in the Field Office Technical Guide, which is available in local offices of the Natural Resources Conservation Service and online at <http://www.nrcs.usda.gov/technical/efotg/>.

Total dry-weight production is the amount of vegetation that can be expected to grow annually in a well-managed area that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year’s growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In a normal year, growing conditions are about average. In an unfavorable year, growing conditions are well

below average, generally because of low available soil moisture. Yields are adjusted to a common percent of air-dry moisture content.

Characteristic native vegetation—the grasses, forbs, and shrubs that make up most of the potential natural plant community on each soil—is listed by common name. Under *rangeland composition*, the expected percentage of the total annual production is given for each species making up the characteristic vegetation. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season.

Rangeland Condition

Rangeland condition is based on a comparison of the present plant community with the potential natural plant community on a particular ecological site. The more closely the existing community resembles the natural community, the better the range condition.

Abnormal disturbances that change the natural plant community include repeated overuse by livestock, excessive burning, erosion, and plowing. Grazing animals select the most palatable plants. These plants will eventually die if they are continually grazed. A very severe disturbance may destroy the natural community. Under these conditions, the less desirable plants, such as annuals and weedlike plants, can invade. If the plant community has not deteriorated significantly, it eventually can return to dominantly natural plants if proper grazing management is applied.

Four range condition classes are used to show the degree of deterioration of the natural plant community. An area of rangeland is in *excellent condition* if more than 75 percent of the present plant community is the same as the natural plant community. It is in *good condition* if the natural plants make up 51 to 75 percent of the present plant community, in *fair condition* if those plants make up 26 to 50 percent, and in *poor condition* if they make up less than 25 percent.

Knowledge of the range site and condition is necessary as a basis for planning and applying the management needed to maintain or improve the desired plant community for selected uses. Such information is needed to determine management objectives, proper grazing systems and stocking rates, suitable wildlife management practices, the potential for recreational uses, and the condition of watersheds.

Rangeland Management

Rangeland management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present range similarity index and rangeland trend. Range similarity index is determined by comparing the present plant community with the potential natural plant community on a particular rangeland ecological site. The more closely the existing community resembles the potential community, the higher the range similarity index. Rangeland trend is defined as the direction of change in an existing plant community relative to the potential natural plant community. Further information about the range similarity index and rangeland trend is available in chapter 4 of the “National Range and Pasture Handbook” (<http://www.glti.nrcs.usda.gov/technical/publications/nrph.html>).

The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the optimum production of vegetation, control of undesirable brush species, conservation of water, and control of erosion. Sometimes, however, an area with a range similarity index somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

Grazing management is the most important part of any rangeland management program. Proper grazing use, timely deferment of grazing, and planned rotation grazing systems are key practices. The experience of ranchers and research has shown that if no more than one-half of the current year's growth is grazed, a plant community in good or excellent condition can be maintained and one in fair condition can be improved. The remaining one-half enables plants to make and store food for regrowth and root development. As a result, the desirable plants remain healthy and are not replaced by less desirable grasses and weeds. Also, the plant cover protects the soil from water erosion and soil blowing, improves tilth, increases the rate of water infiltration, and helps to control runoff.

Certain practices commonly are needed to obtain a uniform distribution of grazing. These practices include developing livestock watering facilities, fencing, properly locating salt and mineral supplements, constructing livestock trails in steeply sloping areas, and riding or herding. The table, "Rangeland Improvement," shows, for each map unit, the limitations to the range improvements of fencing and developing pond reservoir areas.

Various kinds of grazing systems can be used in range management. No single grazing system is best under all conditions. The grazing system should increase the quantity and improve the quality of the range vegetation; should meet the needs of the individual operator; and should be designed according to topography, type of grazing animals, and resource management objectives.

Special improvement practices are needed in areas where management practices do not achieve the desired results or where recovery is too slow under forage management alone. These practices include range seeding, brush management, water spreading, prescribed burning, and mechanical treatment.

Some soils are suited to mechanical treatment for range improvement. On other soils, however, only proper grazing management can improve the range. Capability classes are designated by the numbers 1 through 8. The numbers indicate progressively greater limitations and narrower choices for practical use. Many soils in capability classes 1 through 4 are suited to such practices as seeding, mechanical brush and weed control, and water spreading. Those soils in capability classes 7 and 8, however, are not suitable. Many soils in capability classes 1 through 4 are suited to tillage for seedbed preparation before native or introduced forage plant species are seeded. Soils in capability class 6 may be suited to limited surface disturbance, such as scarification, for seeding and as a means of increasing the rate of water infiltration for seed germination.

Where feasible, mechanical renovation practices, such as shallow chiseling, can help to speed recovery of the desired plants. These practices open up the surface and thus allow absorption of more moisture and production of more desirable plants. Mechanical renovation, brush management, and timely deferment of grazing allow recovery of desired plants.

Seeding may be needed in areas where less desirable plants are dominant. A clean, firm seedbed should be prepared, suitable species should be selected for seeding, and rest periods should be long enough to allow the new plants to become established. Special improvement practices can be effective only if the management system helps to keep the desirable plants healthy.

Forestland Understory Management

Understory vegetation consists of grasses, forbs, shrubs, and other plants. If well managed, some forestland can produce enough understory vegetation to support grazing of livestock or wildlife, or both, without damage to the trees.

Forest understory production can be influenced by controlling canopy density in addition to the management of stocking rates, distribution, and season of use. Often

both the forestland and range resources can be enhanced through thinning the overstory to canopy levels that optimize both timber and forage production. Broadcast seeding of disturbed areas soon after timber harvest can improve forage quantity and quality and reduce the chances of undesirable plants occupying the site.

Steepness of slopes and distance to drinking water are severe grazing management problems in much of the mountain and foothill areas. Variations in primary season of use, production levels, and plant communities because of elevation and aspect changes present additional challenges. Long, steep slopes provide limited access to livestock. Less sloping areas are subject to overuse. Grazing should be delayed until the soil is firm enough to withstand trampling and the plants have matured enough to withstand grazing pressure.

Riparian areas should be protected from overuse by livestock. Misuse results in deterioration of protective vegetation, reduction of streambank stability, and excessive erosion. Developing off-stream-watering locations can successfully prevent cattle from overgrazing riparian areas and encourage better livestock distribution.

Forestland

Robert Logar, State Forester, Natural Resources Conservation Service, prepared this section.

Forest Resource Statistics

There are approximately 355,200 acres in the survey area. Approximately 70,505 acres or 20 percent are forested. Coniferous forests occupy 41,286 acres (approximately 60 percent) and deciduous forests occupy 29,219 acres (approximately 40 percent) of the forested acres within the survey area. The dominant cover types are Douglas-fir, lodgepole pine, black cottonwood, and narrow-leaf cottonwood. Cover types of Rocky Mountain juniper, limber pine, quaking aspen, whitebark pine, and subalpine fir occupy lesser acreage.

Soils vary in their ability to support the growth of trees. Depth, fertility, texture, and available water-holding capacity influence tree growth. Aspect, soils, and climate determine the kinds of trees that can be expected on any site and their growth rate. Forested areas range in elevation from about 5,000 feet along the Beaverhead River to about 9,000 feet along the Blacktail Mountains. The forested soils in the survey area range from shallow to very deep, from nongravelly to extremely gravelly, and from fine textured to coarse textured. Because of differences among the soils as well as differences in climate, topography, and geology, the forests vary in composition and productivity.

Forested Areas

The major part of the coniferous forestland within the survey area can be divided into two general areas—the Blacktail Mountains and the Sweetwater Hills.

The Blacktail Mountains and the Sweetwater Hills have varying degrees of stand density. A Douglas-fir cover type, with lesser areas of lodgepole pine, occupies the area, which is typically within the 15- to 24-inch precipitation zone. The forest understory plant community is dominated by common snowberry, pinegrass, elk sedge, mallow ninebark, and Idaho fescue. Limber pine and Rocky Mountain juniper occupy areas receiving less than 15 inches of precipitation. The soils are primarily steep, shallow to very deep, with some rock outcrop. Limestone, gneiss, schist, and interbedded sandstone and shale bedrock influence the soils in the Blacktail Mountains, while gneiss and schist bedrock influence the soils in the Sweetwater Hills. Soil series associated with the limestone-, sandstone-, and shale-influenced soils are Firada and Whitore. Some soil series on gneiss- and schist-influenced soils are Shadow and Worock.

Quaking aspen is found in random wet areas throughout the survey area. The soils in these areas have moderate to high available water-holding capacity and are located in positions that receive extra moisture. The forest understory plant community is dominated by redosier dogwood, common snowberry, Kentucky bluegrass, and rose. Soil series associated with aspen stands are Elve, Loberg, and Sebud.

The valley bottoms are generally forested with deciduous tree species. The major part of the deciduous forestland can be found along the Beaverhead and Big Hole River valleys. These areas consist of soils that formed in alluvial material and are rarely to occasionally flooded. Narrowleaf and black cottonwood cover types occupy the larger river valley bottoms, which is typically within the 10- to 14- inch precipitation zone. Associated plant communities are dominated by various willows, common snowberry, redosier dogwood, and rose. Soil series commonly occurring in this area are the Dillon, Rivra, and Ryell.

Black cottonwood is found along the tributaries of the Beaverhead and Big Hole River valleys, which are typically within the 15- to 19-inch precipitation zone. Associated plant communities are dominated by various willows, common snowberry, redosier dogwood, and rose. Soil series associated with this area are the Finn and Tibkey.

Forestland Management and Productivity

The tables in this section can help forest owners or managers plan the use of soils for wood crops. They show the potential productivity of the soils for wood crops and rate the soils according to the limitations that affect various aspects of forest management.

Forestland Management

In the “Forestland Management” tables, interpretive ratings are given for various aspects of forest management. The ratings are both verbal and numerical.

Some rating class terms indicate the degree to which the soils are suited to a specified forest management practice. *Well suited* indicates that the soil has features that are favorable for the specified practice and has no limitations. Good performance can be expected, and little or no maintenance is needed. *Moderately suited* indicates that the soil has features that are moderately favorable for the specified practice. One or more soil properties are less than desirable, and fair performance can be expected. Some maintenance is needed. *Poorly suited* indicates that the soil has one or more properties that are unfavorable for the specified practice. Overcoming the unfavorable properties requires special design, extra maintenance, and costly alteration. *Unsuited* indicates that the expected performance of the soil is unacceptable for the specified practice or that extreme measures are needed to overcome the undesirable soil properties.

Numerical ratings in the tables indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the specified forest management practice (1.00) and the point at which the soil feature is not a limitation (0.00).

Rating class terms for fire damage and seedling mortality are expressed as *low*, *moderate*, and *high*. Where these terms are used, the numerical ratings indicate gradations between the point at which the potential for fire damage or seedling mortality is highest (1.00) and the point at which the potential is lowest (0.00).

The paragraphs that follow indicate the soil properties considered in rating the soils for forest management practices. More detailed information about the criteria used in the ratings is available in the “National Forestry Manual,” which is available in local offices of the Natural Resources Conservation Service or on the Internet (<http://soils.usda.gov/technical/nfmanual/>).

For *limitations affecting construction of haul roads and log landings*, the ratings are based on slope, flooding, permafrost, plasticity index, the hazard of soil slippage, content of sand, the Unified classification, rock fragments on or below the surface,

depth to a restrictive layer that is indurated, depth to a water table, and ponding. The limitations are described as slight, moderate, or severe. A rating of *slight* indicates that no significant limitations affect construction activities; *moderate* indicates that one or more limitations can cause some difficulty in construction; and *severe* indicates that one or more limitations can make construction very difficult or very costly.

The ratings of *suitability for log landings* are based on slope, rock fragments on the surface, plasticity index, content of sand, the Unified classification, depth to a water table, ponding, flooding, and the hazard of soil slippage. The soils are described as well suited, moderately suited, or poorly suited to use as log landings.

Ratings in the column *soil rutting hazard* are based on depth to a water table, rock fragments on or below the surface, the Unified classification, depth to a restrictive layer, and slope. Ruts form as a result of the operation of forest equipment. The hazard is described as slight, moderate, or severe. A rating of *slight* indicates that the soil is subject to little or no rutting, *moderate* indicates that rutting is likely, and *severe* indicates that ruts form readily.

Ratings in the column *hazard of off-road or off-trail erosion* are based on slope and on soil erodibility factor K. The soil loss is caused by sheet or rill erosion in off-road or off-trail areas where 50 to 75 percent of the surface has been exposed by logging, grazing, mining, or other kinds of disturbance. The hazard is described as slight, moderate, severe, or very severe. A rating of *slight* indicates that erosion is unlikely under ordinary climatic conditions; *moderate* indicates that some erosion is likely and that erosion-control measures may be needed; *severe* indicates that erosion is very likely and that erosion-control measures, including revegetation of bare areas, are advised; and *very severe* indicates that significant erosion is expected, loss of soil productivity and off-site damage are likely, and erosion-control measures are costly and generally impractical.

Ratings in the column *hazard of erosion on roads and trails* are based on the soil erodibility factor K, slope, and content of rock fragments. The ratings apply to unsurfaced roads and trails. The hazard is described as slight, moderate, or severe. A rating of *slight* indicates that little or no erosion is likely; *moderate* indicates that some erosion is likely, that the roads or trails may require occasional maintenance, and that simple erosion-control measures are needed; and *severe* indicates that significant erosion is expected, that the roads or trails require frequent maintenance, and that costly erosion-control measures are needed.

Ratings in the column *suitability for roads (natural surface)* are based on slope, rock fragments on the surface, plasticity index, content of sand, the Unified classification, depth to a water table, ponding, flooding, and the hazard of soil slippage. The ratings indicate the suitability for using the natural surface of the soil for roads. The soils are described as well suited, moderately suited, or poorly suited to this use.

Ratings in the columns *suitability for hand planting* and *suitability for mechanical planting* are based on slope, depth to a restrictive layer, content of sand, plasticity index, rock fragments on or below the surface, depth to a water table, and ponding. The soils are described as well suited, moderately suited, poorly suited, or unsuited to these methods of planting. It is assumed that necessary site preparation is completed before seedlings are planted.

Ratings in the column *suitability for use of harvesting equipment* are based on slope, rock fragments on the surface, plasticity index, content of sand, the Unified classification, depth to a water table, and ponding. The soils are described as well suited, moderately suited, or poorly suited to this use.

Ratings in the column *suitability for mechanical site preparation (surface)* are based on slope, depth to a restrictive layer, plasticity index, rock fragments on or below the surface, depth to a water table, and ponding. The soils are described as

well suited, poorly suited, or unsuited to this management activity. The part of the soil from the surface to a depth of about 1 foot is considered in the ratings.

Ratings in the column *suitability for mechanical site preparation (deep)* are based on slope, depth to a restrictive layer, rock fragments on or below the surface, depth to a water table, and ponding. The soils are described as well suited, poorly suited, or unsuited to this management activity. The part of the soil from the surface to a depth of about 3 feet is considered in the ratings.

Ratings in the column *potential for damage to soil by fire* are based on texture of the surface layer, content of rock fragments and organic matter in the surface layer, thickness of the surface layer, and slope. The soils are described as having a low, moderate, or high potential for this kind of damage. The ratings indicate an evaluation of the potential impact of prescribed fires or wildfires that are intense enough to remove the duff layer and consume organic matter in the surface layer.

Ratings in the column *potential for seedling mortality* are based on flooding, ponding, depth to a water table, content of lime, reaction, salinity, available water capacity, soil moisture regime, soil temperature regime, aspect, and slope. The soils are described as having a low, moderate, or high potential for seedling mortality.

Forestland Productivity

Expected tree growth rate and the diversity of trees on a site are determined by a combination of elevation, aspect, soils, and climate. The ability of soils to support tree growth is dependent on variability in soil depth, fertility, texture, and available water capacity.

The “Forestland Productivity” table includes the columns *Common Trees*, *Site Index*, *Volume of Wood Fiber*, and *Trees to Manage*.

The column, *Common Trees*, refers to the trees most commonly encountered on the different soils. They are selected on the basis of growth rate, quality, value, and marketability. For the more common trees, particularly those of commercial value, site index values have been determined.

Site Index is a value that ranks soil productivity for a specified tree species. It is determined by taking height measurements and concluding the age of selected trees within stands of a given species (Alexander, 1966). This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. The specified number of years (base age) may be different for different species. The site indexes shown in the “Forestland Productivity” table are averages based on measurements made at sites that are representative of the soil series. The higher the site index number is, the more productive the soil for that species is.

The site index base age is 30 years for narrowleaf cottonwood (locally adapted site index curves developed by NRCS); 50 years for black cottonwood (Sauerwein, 1979), Douglas-fir (Brickell, 1968), and Engelmann spruce; 80 years for quaking aspen (Baker, 1925); and 100 years for lodgepole pine (Alexander, 1966). Therefore, site index values are not directly comparable from one species to another. More detailed information regarding site index is available in the “National Forestry Manual,” which is available in local offices of the Natural Resources Conservation Service or on the Internet (<http://soils.usda.gov/technical/nfmanual/>).

Yields

Site index and yield tables can be used to develop estimates of potential growth for adapted tree species on different soils. Yield estimates in the “Forestland Productivity” table are expressed as average annual cubic feet per acre at CMAI—that point in time when the average annual yield is greatest.

The column, *Volume of Wood Fiber*, in the “Forestland Productivity” table lists the average annual yield estimates in board feet (Scribner’s log rule) per acre for selected tree species. Overstory yield estimates were determined for most species from average annual yield versus site index curves developed through adjustment of data presented in yield tables published from several different sources. Average annual yield values were computed at the culmination of mean annual increment (CMAI).

“Yield Tables for Managed Stands of Lodgepole Pine in Colorado and Wyoming” were used to estimate the board foot yield of lodgepole pine (Myers, 1967). Board-foot volumes in the reference are based on Scribner’s log rule and include all trees larger than 10 inches in diameter breast height to an 8-inch top diameter inside bark. Total cubic foot yield estimates are based on “Gross and Net Yield Tables for Lodgepole Pine” (Dahms, 1964). In this reference, total cubic foot volume estimates (inside bark) are based on all trees with diameter breast height inside the bark of more than one inch. “Aspen in the Central Rocky Mountain Region” (Baker, 1925) was used to estimate quaking aspen yields. Total cubic-foot volume estimates in the reference are based on all trees more than 4 inches diameter breast height. Narrowleaf and black cottonwood yields are based on data collected by the NRCS.

Trees to manage are those that are preferred for planting, seeding, or natural regeneration and those that remain in the stand after thinning or partial harvest. The column lists trees adapted to the site. The first listed tree is likely the most productive tree species to plant on the site.

Forest Understory

Forest understory information can be found in the “Rangeland” section of the manuscript with the use of the “Rangeland and Forest Understory Production and Plant Composition” table. The forest understory information consists of a listing of the understory plant species expected to occur beneath a forest canopy, an estimate of the associated understory production in favorable and unfavorable years, and the habitat type or ecological site description that would best describe the climax plant community.

Recreation

The soils of the survey area are rated in the “Recreation” tables according to limitations that affect their suitability for recreation. The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect the recreational uses. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the tables indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

The ratings in the tables are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation also are important. Soils that are subject to flooding are limited for recreational uses by the duration and intensity of flooding and the season when flooding occurs. In planning recreational facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential. The information in the “Recreation” tables can be supplemented by other information in this survey, for example, interpretations for building site development, construction materials, sanitary facilities, and water management.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The ratings are based on the soil properties that affect the ease of developing camp areas and the performance of the areas after development. Slope, stoniness, and depth to bedrock or a cemented pan are the main concerns affecting the development of camp areas. The soil properties that affect the performance of the areas after development are those that influence trafficability and promote the growth of vegetation, especially in heavily used areas. For good trafficability, the surface of camp areas should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry. The soil properties that influence trafficability are texture of the surface layer, depth to a water table, ponding, flooding, permeability, and large stones. The soil properties that affect the growth of plants are depth to bedrock or a cemented pan, permeability, and toxic substances in the soil.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The ratings are based on the soil properties that affect the ease of developing picnic areas and that influence trafficability and the growth of vegetation after development. Slope and stoniness are the main concerns affecting the development of picnic areas. For good trafficability, the surface of picnic areas should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry. The soil properties that influence trafficability are texture of the surface layer, depth to a water table, ponding, flooding, permeability, and large stones. The soil properties that affect the growth of plants are depth to bedrock or a cemented pan, permeability, and toxic substances in the soil.

Playgrounds require soils that are nearly level, are free of stones, and can withstand intensive foot traffic. The ratings are based on the soil properties that affect the ease of developing playgrounds and that influence trafficability and the growth of vegetation after development. Slope and stoniness are the main concerns affecting the development of playgrounds. For good trafficability, the surface of the playgrounds should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry. The soil properties that influence trafficability are texture of the surface layer, depth to a water table, ponding, flooding, permeability, and large stones. The soil properties that affect the growth of plants are depth to bedrock or a cemented pan, permeability, and toxic substances in the soil.

Paths and trails for hiking and horseback riding should require little or no slope modification through cutting and filling. The ratings are based on the soil properties that affect trafficability and erodibility. These properties are stoniness, depth to a water table, ponding, flooding, slope, and texture of the surface layer.

Off-road motorcycle trails require little or no site preparation. They are not covered with surfacing material or vegetation. Considerable compaction of the soil material is likely. The ratings are based on the soil properties that influence erodibility, trafficability, dustiness, and the ease of revegetation. These properties are stoniness, slope, depth to a water table, ponding, flooding, and texture of the surface layer.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. Irrigation is not considered in the ratings. The ratings are based on the soil properties that affect plant growth and trafficability after vegetation is established. The properties that affect plant growth are reaction; depth to a water table; ponding; depth to bedrock or a cemented pan; the available water capacity in the upper 40 inches; the content of salts, sodium, or calcium carbonate; and sulfidic materials. The properties that affect trafficability are flooding, depth to a water table, ponding, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer. The suitability of the soil for traps, tees, roughs, and greens is not considered in the ratings.

Wildlife Habitat

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

Elements of Wildlife Habitat

The following paragraphs describe the elements of wildlife habitat.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flooding. Soil temperature and soil moisture also are considerations. Examples of grain and seed crops are barley, oats, and wheat.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flooding, and slope. Soil temperature and soil moisture also are considerations. Examples of grasses and legumes are alfalfa, brome grass, clover, orchardgrass, crested wheatgrass, and timothy.

Wild herbaceous plants are native or naturally established forbs and grasses, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flooding. Soil temperature and soil moisture also are considerations. Examples of wild herbaceous plants are blue grama, bluegrass, goldenrod, needlegrass, and wheatgrass.

Deciduous trees and woody understory produce bark, buds, catkins, foliage, nuts or other fruit, and twigs. Soil properties and features that affect the growth of deciduous trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of deciduous trees and woody understory are American elm, birch, boxelder, green ash, maple, oak, poplar, and willow. Examples of fruit-producing trees and shrubs that are suitable for planting on soils that have good potential for these plants are apple, chokecherry, crabapple, hawthorn, redosier dogwood, and Russian olive.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are fir, juniper, pine, and spruce.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are greasewood, mountain mahogany, rabbitbrush, sagebrush, silver buffaloberry, snowberry, and winterfat.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are reeds, rushes, saltgrass, sedges, and smartweed.

Shallow-water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples are marshes, ponds, and waterfowl feeding areas.

Kinds of Wildlife Habitat

Habitat for openland wildlife consists of cropland, meadows, pasture, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. Wildlife attracted to openland areas include cottontail, field sparrow, meadowlark, pheasant, and red fox.

Habitat for woodland wildlife consists of areas of coniferous and/or deciduous plants and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to woodland areas include bear, deer, elk, raccoon, ruffed grouse, squirrel, thrush, wild turkey, woodcock, and woodpecker.

Habitat for wetland wildlife consists of open, marshy or swampy, shallow-water areas. Some of the wildlife attracted to wetland areas include beaver, duck, geese, heron, mink, muskrat, and shore birds.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland areas include antelope, coyote, deer, meadowlark, and sage grouse.

Wildlife of the Dillon Area—Part of Beaverhead County

Habitat quality and interspersions determine wildlife population levels. Suitability of a particular habitat for a wildlife species depends greatly on the nature of the plant communities present. Prevailing land-use practices and management determine the quantity, quality, and distribution of plant communities. These factors are governed to some extent by the soils of the area.

Rating soils for their ability to produce vegetative elements for wildlife habitat does not take into account local climatic influences, present use of soils, juxtaposition of habitat types or elements, or present distribution of wildlife species. For these reasons, the selection and suitability of an area for wildlife habitat development require onsite evaluation.

The survey area provides a variety of wildlife habitats, including coniferous forests, irrigated and nonirrigated cropland, marshes, mountainous areas of rolling foothills, ponds, rangeland, reservoirs, riparian woodland, rivers, and streams.

Rocky Mountain elk occur on foothills and mountain ranges throughout the survey area. They summer mostly on adjacent national forest lands. Movement to lower elevation ranges begins in early to late fall depending on weather conditions, especially snow on south-facing slopes.

Moose most commonly occur along the Big Hole and Beaverhead River drainages. Moose graze high-elevation spruce and fir forests extensively in summer and fall. As winter snows accumulate on high slopes, moose move along drainages to lower-elevation winter ranges where they reach their greatest population densities. Moose are primarily browsers in winter, utilizing a variety of willows and other

deciduous shrubs. During summer, they often feed on aquatic plants of marshes, rivers, and streams.

Both mule deer and white-tailed deer occupy the survey area. Mule deer occur over much of the brushy bottoms, foothills, rough rangeland, and wooded uplands. White-tailed deer generally inhabit the bottomlands along the Big Hole and Beaverhead Rivers, Blacktail Deer Creek and their lower tributaries.

Brushy thickets, cropland, ditchbanks, and riparian woodlands along the Beaverhead River provide habitat for ring-necked pheasant, an introduced species.

Hungarian partridge, an introduced game bird from Europe, is associated with cropland and grassland areas throughout the valley.

Three species of forest-dwelling grouse—blue, spruce, and ruffed—inhabit the coniferous forests and riparian woodlands of the survey area. A variety of habitats, such as brushy draws, mixed forests, and stream bottoms, are important to forest grouse throughout the seasons. Blue grouse and spruce grouse winter at high elevations. In early spring, they descend to semi-open timber areas for breeding, nesting, and rearing of chicks.

Blue grouse habitat is closely associated with the distribution patterns of Douglas-fir and true fir and the soil associations that support forests with these species as components.

Ruffed grouse inhabit the dense cover of coniferous and deciduous shrubs and trees, especially along stream courses. Adult ruffed grouse may spend most of their lives in an area of less than 2 square miles.

Many marshes, ponds, potholes, reservoirs, rivers, and sloughs scattered throughout the survey area provide habitat for an abundance of waterfowl during spring and fall migrations and during the summer production period. Ducks, geese, and a variety of marsh and shore birds use these bodies of water for resting, nesting, and rearing of young.

Beaver, mink, and muskrat inhabit the principal watercourses. Badger, bobcat, coyote, mountain lion, and a variety of small mammals occur throughout the survey area.

Excellent sport fishing is found within the streams, lakes, and rivers of the survey area. Rivers, including the Big Hole, Beaverhead, and their tributaries, abound with a variety of game fish including brook trout, brown trout, cutthroat trout, and rainbow trout.

Populations of game and nongame species can be enhanced by using conservation practices to improve their habitat. These practices include development of odd or irregularly shaped areas in and adjacent to farmland to provide food and cover, protection of habitat from fire or grazing, and establishment of woody vegetation to provide winter shelter. Wildlife habitat may also be enhanced through application of commonly employed conservation practices including minimum tillage, planned grazing systems, pond construction, shelterbelts and field windbreaks, and stripcropping.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. Ratings are given for building site development, sanitary facilities, construction materials, and water management. The ratings are based on observed performance of the soils and on the data in the tables described under the heading "Soil Properties."

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil between the surface and a depth of 5 to 7 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations should be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about particle-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 7 feet of the surface, soil wetness, depth to a water table, ponding, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kinds of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the "Glossary."

Building Site Development

Soil properties influence the development of building sites, including the selection of the site, the design of the structure, construction, performance after construction, and maintenance. The “Dwellings and Small Commercial Buildings” table shows the degree and kind of soil limitations that affect dwellings with and without basements and small commercial buildings.

The ratings in the table are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect building site development. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the table indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

Dwellings are single-family houses of three stories or less. For dwellings without basements, the foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of 2 feet or at the depth of maximum frost penetration, whichever is deeper. For dwellings with basements, the foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of about 7 feet. The ratings for dwellings are based on the soil properties that affect the capacity of the soil to support a load without movement and on the properties that affect excavation and construction costs. The properties that affect the load-supporting capacity include depth to a water table, ponding, flooding, subsidence, linear extensibility (shrink-swell potential), and compressibility. Compressibility is inferred from the Unified classification. The properties that affect the ease and amount of excavation include depth to a water table, ponding, flooding, slope, depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, and the amount and size of rock fragments.

Small commercial buildings are structures that are less than three stories high and do not have basements. The foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of 2 feet or at the depth of maximum frost penetration, whichever is deeper. The ratings are based on the soil properties that affect the capacity of the soil to support a load without movement and on the properties that affect excavation and construction costs. The properties that affect the load-supporting capacity include depth to a water table, ponding, flooding, subsidence, linear extensibility (shrink-swell potential), and compressibility (which is inferred from the Unified classification). The properties that affect the ease and amount of excavation include flooding, depth to a water table, ponding, slope, depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, and the amount and size of rock fragments.

The “Roads and Streets, Shallow Excavations, and Lawns and Landscaping” table shows the degree and kind of soil limitations that affect local roads and streets, shallow excavations, and lawns and landscaping.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base of gravel, crushed rock, or soil material stabilized by lime or cement; and a surface of

flexible material (asphalt), rigid material (concrete), or gravel with a binder. The ratings are based on the soil properties that affect the ease of excavation and grading and the traffic-supporting capacity. The properties that affect the ease of excavation and grading are depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, depth to a water table, ponding, flooding, the amount of large stones, and slope. The properties that affect the traffic-supporting capacity are soil strength (as inferred from the AASHTO group index number), subsidence, linear extensibility (shrink-swell potential), the potential for frost action, depth to a water table, and ponding.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for graves, utility lines, open ditches, or other purposes. The ratings are based on the soil properties that influence the ease of digging and the resistance to sloughing. Depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, the amount of large stones, and dense layers influence the ease of digging, filling, and compacting. Depth to the seasonal high water table, flooding, and ponding may restrict the period when excavations can be made. Slope influences the ease of using machinery. Soil texture, depth to the water table, and linear extensibility (shrink-swell potential) influence the resistance to sloughing.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The properties that affect plant growth are reaction; depth to a water table; ponding; depth to bedrock or a cemented pan; available water capacity in the upper 40 inches; content of salts, sodium, or calcium carbonate; and sulfidic materials. The properties that affect trafficability are flooding; depth to a water table; ponding; slope; stoniness; and the amount of sand, clay, or organic matter in the surface layer. The soils in this survey area have not been rated for potential use for lawns and landscaping because of the degree that the soils have been impacted. Onsite evaluation is required to determine the suitability of the soils for use for lawns and landscaping.

Sanitary Facilities

The “Sanitary Facilities” tables show the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, sanitary landfills, and daily cover for landfill. The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect these uses. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the tables indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 60 inches is evaluated. The ratings are based on the soil properties that affect absorption of the effluent, construction and maintenance of the system, and public health. Permeability, depth to a water table, ponding, depth to bedrock or a cemented pan, and flooding affect absorption of the

effluent. Stones and boulders, ice, and bedrock or a cemented pan interfere with installation. Subsidence interferes with installation and maintenance. Excessive slope may cause lateral seepage and surfacing of the effluent in downslope areas.

Some soils are underlain by loose gravel and sand or fractured bedrock at a depth of less than 4 feet below the distribution lines. In these soils, the absorption field may not adequately filter the effluent, particularly when the system is new. As a result, the ground water may become contaminated.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water. Considered in the ratings are slope, permeability, depth to a water table, ponding, depth to bedrock or a cemented pan, flooding, large stones, and content of organic matter.

Soil permeability is a critical property affecting the suitability for sewage lagoons. Most porous soils eventually become sealed when they are used as sites for sewage lagoons. Until sealing occurs, however, the hazard of pollution is severe. Soils that have a permeability rate of more than 2 inches per hour are too porous for the proper functioning of sewage lagoons. In these soils, seepage of the effluent can result in contamination of the ground water. Ground-water contamination is also a hazard if fractured bedrock is within a depth of 40 inches, if the water table is high enough to raise the level of sewage in the lagoon, or if floodwater overtops the lagoon.

A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor. If the lagoon is to be uniformly deep throughout, the slope must be gentle enough and the soil material must be thick enough over bedrock or a cemented pan to make land smoothing practical.

A *trench sanitary landfill* is an area where solid waste is placed in successive layers in an excavated trench. The waste is spread, compacted, and covered daily with a thin layer of soil excavated at the site. When the trench is full, a final cover of soil material at least 2 feet thick is placed over the landfill. The ratings in the table are based on the soil properties that affect the risk of pollution, the ease of excavation, trafficability, and revegetation. These properties include permeability, depth to bedrock or a cemented pan, depth to a water table, ponding, slope, flooding, texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, onsite investigation may be needed.

Hard, nonrippable bedrock, creviced bedrock, or highly permeable strata in or directly below the proposed trench bottom can affect the ease of excavation and the hazard of ground-water pollution. Slope affects construction of the trenches and the movement of surface water around the landfill. It also affects the construction and performance of roads in areas of the landfill.

Soil texture and consistence affect the ease with which the trench is dug and the ease with which the soil can be used as daily or final cover. They determine the workability of the soil when dry and when wet. Soils that are plastic and sticky when wet are difficult to excavate, grade, or compact and are difficult to place as a uniformly thick cover over a layer of refuse.

The soil material used as the final cover for a trench landfill should be suitable for plants. It should not have excess sodium or salts and should not be too acid. The surface layer generally has the best workability, the highest content of organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

In an *area sanitary landfill*, solid waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site. A final cover of soil material at least 2 feet thick is placed over the completed landfill. The ratings in the table are based on the soil properties that affect trafficability and the risk of pollution. These properties include flooding, permeability, depth to a water table, ponding, slope, and depth to bedrock or a cemented pan.

Flooding is a serious problem because it can result in pollution in areas downstream from the landfill. If permeability is too rapid or if fractured bedrock, a fractured cemented pan, or the water table is close to the surface, the leachate can contaminate the water supply. Slope is a consideration because of the extra grading required to maintain roads in the steeper areas of the landfill. Also, leachate may flow along the surface of the soils in the steeper areas and cause difficult seepage problems.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste. The ratings in the table also apply to the final cover for a landfill. They are based on the soil properties that affect workability, the ease of digging, and the ease of moving and spreading the material over the refuse daily during wet and dry periods. These properties include soil texture, depth to a water table, ponding, rock fragments, slope, depth to bedrock or a cemented pan, reaction, and content of salts, sodium, or lime.

Loamy or silty soils that are free of large stones and excess gravel are the best cover for a landfill. Clayey soils may be sticky and difficult to spread; sandy soils are subject to wind erosion.

Slope affects the ease of excavation and of moving the cover material. Also, it can influence runoff, erosion, and reclamation of the borrow area.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as the final cover for a landfill should be suitable for plants. It should not have excess sodium, salts, or lime and should not be too acid.

Agricultural Waste Management

Soil properties are important considerations in areas where soils are used as sites for the treatment and disposal of organic waste and wastewater. Selection of soils with properties that favor waste management can help to prevent environmental damage.

The "Agricultural Waste Management" tables show the degree and kind of soil limitations affecting the treatment of agricultural waste, including municipal and food-processing wastewater and effluent from lagoons or storage ponds. Municipal wastewater is the waste stream from a municipality. It contains domestic waste and may contain industrial waste. It may have received primary or secondary treatment. It is rarely untreated sewage. Food-processing wastewater results from the preparation of fruits, vegetables, milk, cheese, and meats for public consumption. In places, it is high in content of sodium and chloride. In the context of these tables, the effluent in lagoons and storage ponds is from facilities used to treat or store food-processing wastewater or domestic or animal waste. Domestic and food-processing wastewater is very dilute, and the effluent from the facilities that treat or store it commonly is very low in content of carbonaceous and nitrogenous material; the content of nitrogen commonly ranges from 10 to 30 milligrams per liter. The wastewater from animal waste treatment lagoons or storage ponds, however, has much higher concentrations of these materials, mainly because the manure has not been diluted as much as the

domestic waste. The content of nitrogen in this wastewater generally ranges from 50 to 2,000 milligrams per liter. When wastewater is applied, checks should be made to ensure that nitrogen, heavy metals, and salts are not added in excessive amounts.

The ratings in the tables are for waste management systems that not only dispose of and treat organic waste or wastewater but also are beneficial to crops (application of manure and food-processing waste, application of sewage sludge, and disposal of wastewater by irrigation) and for waste management systems that are designed only for the purpose of wastewater disposal and treatment (overland flow of wastewater, rapid infiltration of wastewater, and slow rate treatment of wastewater).

The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect agricultural waste management. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the tables indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

Application of manure and food-processing waste not only disposes of waste material but also can improve crop production by increasing the supply of nutrients in the soils where the material is applied. Manure is the excrement of livestock and poultry, and food-processing waste is damaged fruit and vegetables and the peelings, stems, leaves, pits, and soil particles removed in food preparation. The manure and food-processing waste are either solid, slurry, or liquid. Their nitrogen content varies. A high content of nitrogen limits the application rate. Toxic or otherwise dangerous wastes, such as those mixed with the lye used in food processing, are not considered in the ratings.

The ratings are based on the soil properties that affect absorption, plant growth, microbial activity, erodibility, the rate at which the waste is applied, and the method by which the waste is applied. The properties that affect absorption include permeability, depth to a water table, ponding, the sodium adsorption ratio, depth to bedrock or a cemented pan, and available water capacity. The properties that affect plant growth and microbial activity include reaction, the sodium adsorption ratio, salinity, and bulk density. The wind erodibility group, the soil erodibility factor K, and slope are considered in estimating the likelihood that wind erosion or water erosion will transport the waste material from the application site. Stones, cobbles, a water table, ponding, and flooding can hinder the application of waste. Permanently frozen soils are unsuitable for waste treatment.

Application of sewage sludge not only disposes of waste material but also can improve crop production by increasing the supply of nutrients in the soils where the material is applied. In the context of this table, sewage sludge is the residual product of the treatment of municipal sewage. The solid component consists mainly of cell mass, primarily bacteria cells that developed during secondary treatment and have incorporated soluble organics into their own bodies. The sludge has small amounts of sand, silt, and other solid debris. The content of nitrogen varies. Some sludge has constituents that are toxic to plants or hazardous to the food chain, such as heavy metals and exotic organic compounds, and should be analyzed chemically prior to use.

The content of water in the sludge ranges from about 98 percent to less than 40 percent. The sludge is considered liquid if it is more than about 90 percent water, slurry if it is 50 to 90 percent water, and solid if it is less than 50 percent water.

The ratings in the table are based on the soil properties that affect absorption, plant growth, microbial activity, erodibility, the rate at which the sludge is applied, and the method by which the sludge is applied. The properties that affect absorption, plant growth, and microbial activity include permeability, depth to a water table, ponding, the sodium adsorption ratio, depth to bedrock or a cemented pan, available water capacity, reaction, salinity, and bulk density. The wind erodibility group, the soil erodibility factor K, and slope are considered in estimating the likelihood that wind erosion or water erosion will transport the waste material from the application site. Stones, cobbles, a water table, ponding, and flooding can hinder the application of sludge. Permanently frozen soils are unsuitable for waste treatment.

Application of wastewater by irrigation not only disposes of municipal wastewater and wastewater from food-processing plants, lagoons, and storage ponds but also can improve crop production by increasing the amount of water available to crops. The ratings in the table are based on the soil properties that affect the design, construction, management, and performance of the irrigation system. The properties that affect design and management include the sodium adsorption ratio, depth to a water table, ponding, available water capacity, permeability, slope, and flooding. The properties that affect construction include stones, cobbles, depth to bedrock or a cemented pan, depth to a water table, and ponding. The properties that affect performance include depth to bedrock or a cemented pan, bulk density, the sodium adsorption ratio, salinity, reaction, and the cation-exchange capacity, which is used to estimate the capacity of a soil to adsorb heavy metals. Permanently frozen soils are not suitable for disposal of wastewater by irrigation.

Overland flow of wastewater is a process in which wastewater is applied to the upper reaches of sloped land and allowed to flow across vegetated surfaces, sometimes called terraces, to runoff-collection ditches. The length of the run generally is 150 to 300 feet. The application rate ranges from 2.5 to 16.0 inches per week. It commonly exceeds the rate needed for irrigation of cropland. The wastewater leaves solids and nutrients on the vegetated surfaces as it flows downslope in a thin film. Most of the water reaches the collection ditch, some is lost through evapotranspiration, and a small amount may percolate to the ground water.

The ratings in the table are based on the soil properties that affect absorption, plant growth, microbial activity, and the design and construction of the system. Reaction and the cation-exchange capacity affect absorption. Reaction, salinity, and the sodium adsorption ratio affect plant growth and microbial activity. Slope, permeability, depth to a water table, ponding, flooding, depth to bedrock or a cemented pan, stones, and cobbles affect design and construction. Permanently frozen soils are unsuitable for waste treatment.

Rapid infiltration of wastewater is a process in which wastewater applied in a level basin at a rate of 4 to 120 inches per week percolates through the soil. The wastewater may eventually reach the ground water. The application rate commonly exceeds the rate needed for irrigation of cropland. Vegetation is not a necessary part of the treatment; hence, the basins may or may not be vegetated. The thickness of the soil material needed for proper treatment of the wastewater is more than 72 inches. As a result, geologic and hydrologic investigation is needed to ensure proper design and performance and to determine the risk of ground-water pollution.

The ratings in the table are based on the soil properties that affect the risk of pollution and the design, construction, and performance of the system. Depth to a water table, ponding, flooding, and depth to bedrock or a cemented pan affect the risk of pollution and the design and construction of the system. Slope, stones, and

cobbles also affect design and construction. Permeability and reaction affect performance. Permanently frozen soils are unsuitable for waste treatment.

Slow rate treatment of wastewater is a process in which wastewater is applied to land at a rate normally between 0.5 inch and 4.0 inches per week. The application rate commonly exceeds the rate needed for irrigation of cropland. The applied wastewater is treated as it moves through the soil. Much of the treated water may percolate to the ground water, and some enters the atmosphere through evapotranspiration. The applied water generally is not allowed to run off the surface. Waterlogging is prevented through either control of the application rate or through the use of tile drains, or both.

The ratings in the table are based on the soil properties that affect absorption, plant growth, microbial activity, erodibility, and the application of waste. The properties that affect absorption include the sodium adsorption ratio, depth to a water table, ponding, available water capacity, permeability, depth to bedrock or a cemented pan, reaction, the cation-exchange capacity, and slope. Reaction, the sodium adsorption ratio, salinity, and bulk density affect plant growth and microbial activity. The wind erodibility group, the soil erodibility factor K, and slope are considered in estimating the likelihood of wind erosion or water erosion. Stones, cobbles, a water table, ponding, and flooding can hinder the application of waste. Permanently frozen soils are unsuitable for waste treatment.

Construction Materials

The “Construction Materials” tables give information about the soils as potential sources of gravel and sand, reclamation material, and roadfill. Normal compaction, minor processing, and other standard construction practices are assumed.

Gravel and *Sand* are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction. Specifications for each use vary widely. In the “Construction Materials” tables, only the likelihood of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material. The properties used to evaluate the soil as a source of gravel or sand are gradation of grain sizes (as indicated by the Unified classification of the soil), the thickness of suitable material, and the content of rock fragments. If the bottom layer of the soil contains gravel or sand, the soil is considered a likely source regardless of thickness. The assumption is that the gravel or sand layer below the depth of observation exceeds the minimum thickness.

The soils are rated *good*, *fair*, or *poor* as potential sources of gravel and sand. A rating of *good* or *fair* means that the source material is likely to be in or below the soil. The bottom layer and the thickest layer of the soils are assigned numerical ratings. These ratings indicate the likelihood that the layer is a source of gravel or sand. The number 0.00 indicates that the layer is a poor source. The number 1.00 indicates that the layer is a good source. A number between 0.00 and 1.00 indicates the degree to which the layer is a likely source.

The soils are rated *good*, *fair*, or *poor* as potential sources of reclamation material and roadfill. The features that limit the soils as sources of these materials are specified in the tables. The numerical ratings given after the specified features indicate the degree to which the features limit the soils as sources of reclamation material or roadfill. The lower the number, the greater the limitation.

Reclamation material is used in areas that have been drastically disturbed by surface mining or similar activities. When these areas are reclaimed, layers of soil material or unconsolidated geological material, or both, are replaced in a vertical sequence. The reconstructed soil favors plant growth. The ratings in the table do not apply to quarries and other mined areas that require an offsite source of

reconstruction material. The ratings are based on the soil properties that affect erosion and stability of the surface and the productive potential of the reconstructed soil. These properties include the content of sodium, salts, and calcium carbonate; reaction; available water capacity; erodibility; texture; content of rock fragments; and content of organic matter and other features that affect fertility.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the whole soil, from the surface to a depth of about 5 feet. It is assumed that soil layers will be mixed when the soil material is excavated and spread.

The ratings are based on the amount of suitable material and on soil properties that affect the ease of excavation and the performance of the material after it is in place. The thickness of the suitable material is a major consideration. The ease of excavation is affected by large stones, depth to a water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the AASHTO classification of the soil) and linear extensibility (shrink-swell potential).

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area. Toxic substances, soil reaction, and the properties that are inferred from soil texture, such as available water capacity and fertility, affect plant growth. The ease of excavating, loading, and spreading is affected by rock fragments, slope, depth to a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, depth to a water table, rock fragments, depth to bedrock or a cemented pan, and toxic material. The soils in this survey area have not been rated for potential use as topsoil because of the degree that the soils have been impacted. Onsite evaluation is required to determine the suitability of the soils for use as topsoil.

Water Management

The “Ponds and Embankments” table gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed excavated ponds. The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect these uses. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the tables indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or

other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. Embankments that have zoned construction (core and shell) are not considered. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey.

Soil properties are ascertained by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine particle-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help to characterize key soils.

The estimates of soil properties are shown in tables. They include engineering index properties, physical and chemical properties, and pertinent soil and water features.

Engineering Index Properties

The “Engineering Index Properties” table gives the engineering classifications and the range of index properties for the layers of each soil in the survey area.

Depth to the upper and lower boundaries of each layer is indicated.

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. “Loam,” for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is 15 percent or more, an appropriate modifier is added, for example, “gravelly.” Textural terms are defined in the “Glossary.”

Classification of the soils is determined according to the Unified soil classification system (ASTM, 2005) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 2004).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to particle-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 based on particle-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 based on visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional

refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 10 inches in diameter and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and plasticity index (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of particle-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is generally omitted in the table.

Physical Properties

The "Physical Properties of the Soils" table shows estimates of some physical characteristics and features that affect soil behavior. These estimates are given for the layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated.

Particle size is the effective diameter of a soil particle as measured by sedimentation, sieving, or micrometric methods. Particle sizes are expressed as classes with specific effective diameter class limits. The broad classes are sand, silt, and clay, ranging from the larger to the smaller.

Clay as a separate class consists of mineral soil particles that are less than 0.002 millimeter in diameter. In the table, the estimated clay content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of sand, silt, and clay affects the physical behavior of a soil. Particle size is important for engineering and agronomic interpretations, for determination of soil hydrologic qualities, and for soil classification.

The amount and kind of clay affect the fertility and physical condition of the soil and the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (oven-dry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at $1/3$ - or $1/10$ -bar (33kPa or 10kPa) moisture tension. Weight is determined after the soil is dried at 105 degrees C. In the table, the estimated moist bulk density of each soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. Depending on soil texture, a bulk density of more than 1.4 can restrict water storage

and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Saturated hydraulic conductivity refers to the ability of a soil to transmit water or air. The term “permeability,” as used in soil surveys, indicates saturated hydraulic conductivity (K_{sat}). The estimates in the table indicate the rate of water movement, in micrometers per second (um/sec), when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems and septic tank absorption fields.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each soil layer. The capacity varies, depending on soil properties that affect retention of water. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Linear extensibility refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. It is an expression of the volume change between the water content of the clod at $1/3$ - or $1/10$ -bar tension (33kPa or 10kPa tension) and oven dryness. The volume change is reported in the table as percent change for the whole soil. Volume change is influenced by the amount and type of clay minerals in the soil. Linear extensibility is used to determine the shrink-swell potential of soils. The shrink-swell potential is low if the soil has a linear extensibility of less than 3 percent; moderate if 3 to 6 percent; high if 6 to 9 percent; and very high if more than 9 percent. If the linear extensibility is more than 3, shrinking and swelling can cause damage to buildings, roads, and other structures and to plant roots. Special design commonly is needed.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In the “Physical Properties of the Soils” table, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained by returning crop residue to the soil. Organic matter has a positive effect on available water capacity, water infiltration, soil organism activity, and tilth. It is a source of nitrogen and other nutrients for crops and soil organisms.

Erosion factors are shown in the table as the K factor (K_w and K_f) and the T factor. Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and permeability. Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor K_w indicates the erodibility of the whole soil. The estimates are modified by the presence of rock fragments.

Erosion factor K_f indicates the erodibility of the fine-earth fraction, or the material less than 2 millimeters in size.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their susceptibility to wind erosion in cultivated areas. The soils assigned to group 1

are the most susceptible to wind erosion, and those assigned to group 8 are the least susceptible. The groups are as follows:

1. Coarse sands, sands, fine sands, and very fine sands.
2. Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, ash material, and sapric soil material.
3. Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams.
- 4L. Calcareous loams, silt loams, clay loams, and silty clay loams.
4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay.
5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material.
6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay.
7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material.
8. Soils that are not subject to wind erosion because of rock fragments on the surface or because of surface wetness.

Wind erodibility index is a numerical value indicating the susceptibility of soil to wind erosion, or the tons per acre per year that can be expected to be lost to wind erosion. There is a close correlation between wind erosion and the texture of the surface layer, the size and durability of surface clods, rock fragments, organic matter, and a calcareous reaction. Soil moisture and frozen soil layers also influence wind erosion.

Chemical Properties

The "Chemical Properties of the Soils" table shows estimates of some chemical characteristics and features that affect soil behavior. These estimates are given for the layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated.

Cation-exchange capacity is the total amount of extractable bases that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. Soils having a low cation-exchange capacity hold fewer cations and may require more frequent applications of fertilizer than soils having a high cation-exchange capacity. The ability to retain cations reduces the hazard of ground-water pollution.

Effective cation-exchange capacity refers to the sum of extractable bases plus aluminum expressed in terms of milliequivalents per 100 grams of soil. It is determined for soils that have pH of less than 5.5.

Soil reaction is a measure of acidity or alkalinity. The pH of each soil horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Calcium carbonate equivalent is the percent of carbonates, by weight, in the fraction of the soil less than 2 millimeters in size. The availability of plant nutrients is influenced by the amount of carbonates in the soil. Incorporating nitrogen fertilizer into calcareous soils helps to prevent nitrite accumulation and ammonium-N volatilization.

Gypsum is expressed as a percent, by weight, of hydrated calcium sulfates in the fraction of the soil less than 20 millimeters in size. Gypsum is partially soluble in

water. Soils that have a high content of gypsum may collapse if the gypsum is removed by percolating water.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Sodium adsorption ratio (SAR) is a measure of the amount of sodium (Na) relative to calcium (Ca) and magnesium (Mg) in the water extract from saturated soil paste. It is the ratio of the Na concentration divided by the square root of one-half of the Ca + Mg concentration. Soils that have SAR values of 13 or more may be characterized by an increased dispersion of organic matter and clay particles, reduced permeability and aeration, and a general degradation of soil structure.

Water Features

The “Water Features” table gives estimates of various water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas.

The *months* in the table indicate the portion of the year in which the feature is most likely to be a concern.

Water table refers to a saturated zone in the soil. The table indicates, by month, depth to the top (*upper limit*) and base (*lower limit*) of the saturated zone in most years. Estimates of the upper and lower limits are based mainly on observations of the water table at selected sites and on evidence of a saturated zone, namely grayish colors or mottles (redox features) in the soil. A saturated zone that lasts for less than a month is not considered a water table.

Ponding is standing water in a closed depression. Unless a drainage system is installed, the water is removed only by percolation, transpiration, or evaporation. The table indicates *surface water depth* and the *duration* and *frequency* of ponding. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, *long* if 7 to 30 days, and *very long* if more than 30 days. Frequency is expressed as none, rare, occasional, and frequent. *None* means that ponding is not probable; *rare* that it is unlikely but possible under unusual weather conditions (the chance of ponding is nearly 0 percent to 5 percent in any year); *occasional* that it occurs, on average, once or less in 2 years (the chance of ponding is 5 to 50 percent in any year); and *frequent* that it occurs, on average, more than once in 2 years (the chance of ponding is more than 50 percent in any year).

Flooding is the temporary inundation of an area caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, and water standing in swamps and marshes is considered ponding rather than flooding.

Duration and *frequency* are estimated. Duration is expressed as *extremely brief* if 0.1 hour to 4 hours, *very brief* if 4 hours to 2 days, *brief* if 2 to 7 days, *long* if 7 to 30 days, and *very long* if more than 30 days. Frequency is expressed as none, very rare, rare, occasional, frequent, and very frequent. *None* means that flooding is not probable; *very rare* that it is very unlikely but possible under extremely unusual weather conditions (the chance of flooding is less than 1 percent in any year); *rare* that it is unlikely but possible under unusual weather conditions (the chance of flooding is 1 to 5 percent in any year); *occasional* that it occurs infrequently under normal weather conditions (the chance of flooding is 5 to 50 percent in any year); *frequent* that it is likely to occur often under normal weather conditions (the chance of flooding is more than 50 percent in any year but is less than 50 percent in all months in any year); and *very frequent* that it is likely to occur very often under normal weather conditions (the chance of flooding is more than 50 percent in all months of any year).

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and little or no horizon development.

Also considered is local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

Soil Features

The "Soil Features" table gives estimates of various soil features. The estimates are used in land use planning that involves engineering considerations.

A *restrictive layer* is a nearly continuous layer that has one or more physical, chemical, or thermal properties that significantly impede the movement of water and air through the soil or that restrict roots or otherwise provide an unfavorable root environment. Examples are bedrock, cemented layers, dense layers, and frozen layers. The table indicates the hardness and thickness of the restrictive layer, both of which significantly affect the ease of excavation. *Depth to top* is the vertical distance from the soil surface to the upper boundary of the restrictive layer.

Subsidence is the settlement of organic soils or of saturated mineral soils of very low density. Subsidence generally results from either desiccation and shrinkage or oxidation of organic material, or both, following drainage. Subsidence takes place gradually, usually over a period of several years. The table shows the expected initial subsidence, which usually is a result of drainage, and total subsidence, which results from a combination of factors.

Potential for frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured, clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that corrodes or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors results in a severe hazard of corrosion. The steel or concrete in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than the steel or concrete in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion also is expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

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Glossary

Ablation till. Loose, permeable till deposited during the final downwasting of glacial ice. Lenses of crudely sorted sand and gravel are common.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well-aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil. (See Sodic (alkali) soil.)

Alluvial fan. A body of alluvium, with overflow of water and debris flow deposits, whose surface forms a segment of a cone that radiates downslope from the point where the stream emerges from a narrow valley onto a less sloping surface. Source uplands range in relief and areal extent from mountains to gullied terrains on hillslopes.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Alpha,alpha-dipyridyl. A dye that when dissolved in 1N ammonium acetate is used to detect the presence of reduced iron (Fe II) in the soil. A positive reaction indicates a type of redox feature.

Animal-unit-month (AUM). The amount of forage required by one mature cow of approximately 1,000 pounds weight, with or without a calf, for 1 month.

Aquic conditions. Current soil wetness characterized by saturation, reduction, and redox features.

Argillite. Weakly metamorphosed mudstone or shale.

Aspect. The direction in which a slope faces.

Association, soil. A group of soils or miscellaneous areas geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low	0 to 3.75
Low	3.75 to 5.0
Moderate	5.0 to 7.5
High	more than 7.5

Avalanche chute. The track or path formed by an avalanche.

Backslope. The geomorphic component that forms the steepest inclined surface and principal element of many hillslopes. Backslopes in profile are commonly steep and linear and descend to a footslope. In terms of gradational process, backslopes are erosional forms produced mainly by mass wasting and running water.

- Badland.** Steep or very steep, commonly nonstony, barren land dissected by many intermittent drainage channels. Badland is most common in semiarid and arid regions where streams are entrenched in soft geologic material. Local relief generally ranges from 25 to 500 feet. Runoff potential is very high, and geologic erosion is active.
- Basal area.** The area of a cross section of a tree, generally referring to the section at breast height and measured outside the bark. It is a measure of stand density, commonly expressed in square feet.
- Basal till.** Compact glacial till deposited beneath the ice.
- Base saturation.** The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, and K), expressed as a percentage of the total cation-exchange capacity.
- Base slope.** A geomorphic component of hills consisting of the concave to linear (perpendicular to the contour) slope that, regardless of the lateral shape, forms an apron or wedge at the bottom of a hillside dominated by colluvium and slope-wash sediments (for example, slope alluvium).
- Bedding planes.** Fine strata, less than 5-millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediment.
- Bedrock.** The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.
- Bedrock-floored plain.** An extensive nearly level to gently rolling or moderately sloping area that is underlain by hard bedrock and has a slope of 0 to 8 percent.
- Bench terrace.** A raised, level or nearly level strip of earth constructed on or nearly on a contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.
- Blowout.** A shallow depression from which all or most of the soil material has been removed by the wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of cobbles or gravel. In some blowouts, the water table is exposed.
- Board foot.** A unit of measure of the wood in lumber, logs, or trees. The amount of wood in a board 1 foot wide, 1 foot long, and 1 inch thick before finishing.
- Bottom land.** The normal flood plain of a stream, subject to flooding.
- Boulders.** Rock fragments larger than 2 feet (60 centimeters) in diameter.
- Bouldery.** Refers to a soil with .01 to 0.1 percent of the surface covered with boulders.
- Bouldery soil material.** Soil that is 15 to 35 percent, by volume, rock fragments that are dominated by fragments larger than 24 inches (60 centimeters) in diameter.
- Breaks.** The steep and very steep broken land at the border of an upland summit that is dissected by ravines.
- Breast height.** An average height of 4.5 feet above the ground surface; the point on a tree where diameter measurements are ordinarily taken.
- Brush management.** Use of mechanical, chemical, or biological methods to reduce or eliminate competition from woody vegetation and thus to allow understory grasses and forbs to recover or to make conditions favorable for reseeding. Brush management increases forage production and thus reduces the hazard of erosion. It can improve the habitat for some species of wildlife.
- Cable yarding.** A method of moving felled trees to a nearby central area for transport to a processing facility. Most cable yarding systems involve use of a drum, a pole, and wire cables in an arrangement similar to that of a rod and reel used for fishing. To reduce friction and soil disturbance, felled trees generally are reeled in while one end is lifted or the entire log is suspended.
- Calcareous soil.** A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

- Caliche.** A more or less cemented deposit of calcium carbonate in soils of warm-temperate, subhumid to arid areas. Caliche occurs as soft, thin layers in the soil or as hard, thick beds directly beneath the solum, or it is exposed at the surface by erosion.
- California bearing ratio (CBR).** The load-supporting capacity of a soil as compared to that of standard crushed limestone, expressed as a ratio. First standardized in California. A soil having a CBR of 16 supports 16 percent of the load that would be supported by standard crushed limestone, per unit area, with the same degree of distortion.
- Canopy.** The leafy crown of trees or shrubs. (See Crown.)
- Capillary water.** Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.
- Cation.** An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.
- Cation-exchange capacity.** The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.
- Channeled.** Refers to a drainage area in which natural meandering or repeated branching and convergence of a streambed have created deeply incised cuts, either active or abandoned, in alluvial material.
- Channery soil material.** A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a channer.
- Chemical treatment.** Control of unwanted vegetation through the use of chemicals.
- Chiseling.** Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compacted layers to a depth below normal plow depth.
- Clay.** As a soil separate, the mineral soil particles less than 0.002 millimeters in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.
- Clayey soil.** Silty clay, sandy clay, or clay.
- Clay film.** A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.
- Claypan.** A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.
- Clearcut.** A method of forest harvesting that removes the entire stand of trees in one cutting. Reproduction is achieved artificially or by natural seeding from the adjacent stands.
- Climax plant community.** The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.
- Closed depression.** A low area completely surrounded by higher ground and having no natural outlet.
- Coarse textured soil.** Sand or loamy sand.
- Cobble (or cobblestone).** A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.
- Cobbly soil material.** Material that has 15 to 35 percent, by volume, rounded or partially rounded rock fragments 3 to 10 inches (7.6 to 25 centimeters) in diameter. Very cobbly soil material has 35 to 60 percent of these rock fragments, and extremely cobbly soil material has more than 60 percent.

- Codominant trees.** Trees whose crowns form the general level of the forest canopy and that receive full light from above but comparatively little from the sides.
- COLE (coefficient of linear extensibility).** (See Linear extensibility.)
- Colluvium.** Soil material or rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.
- Commercial forest.** Forestland capable of producing 20 cubic feet or more per acre per year at the culmination of mean annual increment.
- Complex slope.** Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.
- Complex, soil.** A map unit of two or more kinds of soil or miscellaneous areas in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas.
- Concretions.** Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.
- Conglomerate.** A coarse-grained, clastic rock composed of rounded or subangular rock fragments more than 2 millimeters in diameter. It commonly has a matrix of sand and finer-textured material. Conglomerate is the consolidated equivalent of gravel.
- Conservation cropping system.** Growing crops in combination with needed cultural and management practices. In a good conservation cropping system, the soil-improving crops and practices more than offset the effects of the soil-depleting crops and practices. Cropping systems are needed on all tilled soils. Soil-improving practices in a conservation cropping system include the use of rotations that contain grasses and legumes and the return of crop residue to the soil. Other practices include the use of green manure crops of grasses and legumes, proper tillage, adequate fertilization, and weed and pest control.
- Conservation tillage.** Any tillage and planting system in which a cover of crop residue is maintained on at least 30 percent of the soil surface after planting in order to reduce the hazard of water erosion. In areas where soil blowing is the primary concern, a system that maintains a cover of at least 1,000 pounds of flat residue of small grain or the equivalent during the critical erosion period.
- Consistence, soil.** Refers to the degree of cohesion and adhesion of soil material and its resistance to deformation when ruptured. Consistence includes resistance of soil material to rupture and to penetration; plasticity, toughness, and stickiness of puddled soil material; and the manner in which the soil material behaves when subject to compression. Terms describing consistence are defined in the "Soil Survey Manual" (Soil Survey Division Staff, 1993).
- Consolidated sandstone.** Sandstone that disperses within a few hours when fragments are placed in water. The fragments are extremely hard or very hard when dry, are not easily crushed, and cannot be textured by the usual field method.
- Consolidated shale.** Shale that disperses within a few hours when fragments are placed in water. The fragments are extremely hard or very hard when dry and are not easily crushed.
- Contour stripcropping (or contour farming).** Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.
- Control section.** The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

- Coprogenous earth (sedimentary peat).** Fecal material deposited in water by aquatic organisms.
- Corrosion.** Soil-induced electrochemical or chemical action that dissolves or weakens concrete or uncoated steel.
- Cover crop.** A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.
- Crop residue management.** Returning crop residue to the soil, which helps to maintain soil structure, organic matter content, and fertility and helps to control erosion.
- Cropping system.** Growing crops according to a planned system of rotation and management practices.
- Cross-slope farming.** Deliberately conducting farming operations on sloping farmland in such a way that tillage is across the general slope.
- Crown.** The upper part of a tree or shrub, including the living branches and their foliage.
- Culmination of the mean annual increment (CMAI).** The average annual increase per acre in the volume of a stand. Computed by dividing the total volume of the stand by its age. As the stand increases in age, the mean annual increment continues to increase until mortality begins to reduce the rate of increase. The point where the stand reaches its maximum annual rate of growth is called the culmination of the mean annual increment.
- Cutbanks cave (in tables).** The walls of excavations tend to cave in or slough.
- Decreasers.** The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.
- Deep soil.** A soil that is 40 to 60 inches deep over bedrock or to other material that restricts the penetration of plant roots.
- Deferred grazing.** Postponing grazing or resting grazing land for a prescribed period.
- Dense layer (in tables).** A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.
- Depth, soil.** Generally, the thickness of the soil over bedrock. Very deep soils are more than 60 inches deep over bedrock; deep soils, 40 to 60 inches; moderately deep, 20 to 40 inches; shallow, 10 to 20 inches; and very shallow, less than 10 inches.
- Depth to rock (in tables).** Bedrock is too near the surface for the specified use.
- Dip slope.** A slope of the land surface, roughly determined by and approximately conforming to the dip of the underlying bedrock.
- Diversion (or diversion terrace).** A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.
- Divided-slope farming.** A form of field stripcropping in which crops are grown in a systematic arrangement of two strips, or bands, across the slope to reduce the hazard of water erosion. One strip is in a close-growing crop that provides protection from erosion, and the other strip is in a crop that provides less protection from erosion. This practice is used where slopes are not long enough to permit a full stripcropping pattern to be used.
- Dominant trees.** Trees whose crowns form the general level of the forest canopy and that receive full light from above and from the sides.
- Drainage class (natural).** Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—These soils have very high and high hydraulic conductivity and a low water-holding capacity. They are not suited to crop production unless irrigated.

Somewhat excessively drained.—These soils have high hydraulic conductivity and a low water-holding capacity. Without irrigation, only a narrow range of crops can be grown, and yields are low.

Well drained.—These soils have an intermediate water-holding capacity. They retain optimum amounts of moisture, but they are not wet close enough to the surface or long enough during the growing season to adversely affect yields.

Moderately well drained.—These soils are wet close enough to the surface or long enough that planting or harvesting operations or yields of some field crops are adversely affected unless a drainage system is installed. Moderately well-drained soils commonly have a layer with low hydraulic conductivity, a wet layer relatively high in the profile, additions of water by seepage, or some combination of these.

Somewhat poorly drained.—These soils are wet close enough to the surface or long enough that planting or harvesting operations or crop growth is markedly restricted unless a drainage system is installed. Somewhat poorly drained soils commonly have a layer with low hydraulic conductivity, a wet layer high in the profile, additions of water through seepage, or a combination of these.

Poorly drained.—These soils commonly are so wet, at or near the surface, during a considerable part of the year that field crops cannot be grown under natural conditions. Poorly drained conditions are caused by a saturated zone, a layer with low hydraulic conductivity, seepage, or a combination of these.

Very poorly drained.—These soils are wet to the surface most of the time. The wetness prevents the growth of important crops (except rice) unless a drainage system is installed.

Drainage, surface. Runoff, or surface flow of water, from an area.

Drainageway. An area of ground at a lower elevation than the surrounding ground and in which water collects and is drained to a closed depression or lake or to a drainageway at a lower elevation. A drainageway may or may not have distinctly incised channels at its upper reaches or throughout its course.

Drumlin. A low, smooth, elongated oval hill, mound, or ridge of compact glacial till. The longer axis is parallel to the path of the glacier and commonly has a blunt nose pointing in the direction from which the ice approached.

Duff. A generally firm organic layer on the surface of mineral soils. It consists of fallen plant material that is in the process of decomposition and includes everything from the litter on the surface to underlying pure humus.

Dune. A mound, ridge, or hill of loose, windblown granular material (generally sand), either bare or covered with vegetation.

Ecological site. An area where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. An ecological site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other ecological sites in kind and/or proportion of species or in total production.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Endosaturation. A type of saturation of the soil in which all horizons between the upper boundary of saturation and a depth of 2 meters are saturated.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

- Ephemeral stream.** A stream, or reach of a stream, that flows only in direct response to precipitation. It receives no long-continued supply from melting snow or other source, and its channel is above the water table at all times.
- Episaturation.** A type of saturation indicating a perched water table in a soil in which saturated layers are underlain by one or more unsaturated layers within 2 meters of the surface.
- Erosion.** The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.
Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.
Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, such as fire, that exposes the surface.
- Erosion pavement.** A layer of gravel or stones that remains on the surface after fine particles are removed by sheet or rill erosion.
- Escarpment.** A relatively continuous and steep slope or cliff breaking the general continuity of more gently sloping land surfaces and resulting from erosion or faulting. Synonym: scarp.
- Esker.** A long, narrow, sinuous, steep-sided ridge composed of irregularly stratified sand and gravel that were deposited by a subsurface stream flowing between ice walls or through ice tunnels of a retreating glacier and that were left behind when the ice melted. Eskers range from less than a mile to more than 100 miles in length and from 10 to 100 feet in height.
- Even aged.** Refers to a stand of trees in which only small differences in age occur between individual trees. A range of 20 years is allowed.
- Extrusive rock.** Igneous rock derived from deep-seated molten matter (magma) emplaced on the earth's surface.
- Fallow.** Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grain is grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.
- Fertility, soil.** The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.
- Fibric soil material (peat).** The least decomposed of all organic soil material. Peat contains a large amount of well-preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.
- Field moisture capacity.** The moisture content of a soil, expressed as a percentage of the oven-dry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity*, *normal moisture capacity*, or *capillary capacity*.
- Fine textured soil.** Sandy clay, silty clay, or clay.
- Firebreak.** Area cleared of flammable material to stop or help control creeping or running fires. It also serves as a line from which to work and to facilitate the movement of firefighters and equipment. Designated roads also serve as firebreaks.
- First bottom.** The normal flood plain of a stream, subject to frequent or occasional flooding.
- Flaggy soil material.** Material that has, by volume, 15 to 35 percent flagstones. Very flaggy soil material has 35 to 60 percent flagstones, and extremely flaggy soil material has more than 60 percent flagstones.

- Flagstone.** A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist 6 to 15 inches (15 to 38 centimeters) long.
- Flood plain.** A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.
- Fluvial.** Of or pertaining to rivers; produced by river action, as a fluvial plain.
- Foothill.** A steeply sloping upland that has relief of as much as 1,000 feet (300 meters) and fringes a mountain range or high-plateau escarpment.
- Footslope.** The geomorphic component that forms the inner, gently inclined surface at the base of a hillslope. The surface profile is dominantly concave. In terms of gradational processes, a footslope is a transitional zone between an upslope site of erosion (backslope) and a downslope site of deposition (toeslope).
- Forb.** Any herbaceous plant not a grass or a sedge.
- Forest cover.** All trees and other woody plants (underbrush) covering the ground in a forest.
- Forest type.** A stand of trees similar in composition and development because of given physical and biological factors by which it may be differentiated from other stands.
- Fragipan.** A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.
- Frost action (in tables).** Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.
- Genesis, soil.** The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.
- Giant ripple mark.** The undulating surface sculpture produced in noncoherent granular materials by currents of water and by the agitation of water in wave action during the draining of large glacial lakes, such as Glacial Lake Missoula.
- Glacial drift.** Pulverized and other rock material transported by glacial ice and then deposited. Also, the sorted and unsorted material deposited by streams flowing from glaciers.
- Glacial outwash.** Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.
- Glacial till.** Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.
- Glaciated uplands.** Land areas that were previously covered by continental or alpine glaciers and that are at a higher elevation than the flood plain.
- Glaciofluvial deposits.** Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.
- Glaciolacustrine deposits.** Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are interbedded or laminated.
- Gleyed soil.** Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors.
- Grassed waterway.** A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.
- Gravel.** Rounded or angular fragments of rock as much as 3 inches (7.6 centimeters) in diameter. An individual piece is a pebble.
- Gravelly soil material.** Soil that is 15 to 35 percent, by volume, rounded or angular rock fragments up to 3 inches (7.6 centimeters) in diameter. Very gravelly soil is

35 to 60 percent gravel, and extremely gravelly soil is more than 60 percent gravel by volume.

Grazable forestland. Land capable of sustaining livestock grazing by producing forage of sufficient quantity during one or more stages of secondary forest succession.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water. Water filling all the unblocked pores of the material below the water table.

Gypsum. A mineral consisting of hydrous calcium sulfate.

Habitat type. An aggregation of all land areas capable of producing similar climax plant communities.

Hard bedrock. Bedrock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Head out. To form a flower head.

Heavy metal. Inorganic substances that are solid at ordinary temperatures and are not soluble in water. They form oxides and hydroxides that are basic. Examples are copper, iron, cadmium, zinc, manganese, lead, and arsenic.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric material and the more decomposed sapric material.

High-residue crops. Such crops as small grain and corn used for grain. If properly managed, residue from these crops can be used to control erosion until the next crop in the rotation is established. These crops return large amounts of organic matter to the soil.

Hill. A natural elevation of the land surface, rising as much as 1,000 feet above surrounding lowlands, commonly of limited summit area and having a well-defined outline; hillsides generally have slopes of more than 8 percent. The distinction between a hill and a mountain is arbitrary and is dependent on local usage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the "Soil Survey Manual" (Soil Survey Division Staff, 1993). The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an A or E horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying soil material. The material of a C horizon may be either like or

unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Sedimentary beds of consolidated sandstone and semiconsolidated and consolidated shale. Generally, roots can penetrate this horizon only along fracture planes.

R layer.—Consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon, but it can be directly below an A or a B horizon.

Humus. The well-decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Igneous rock. Rock formed by solidification from a molten or partially molten state. Major varieties include plutonic and volcanic rock. Examples are andesite, basalt, and granite.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impacted, moderately. Moderately impacted soils generally have good ground coverage, but species present are mainly restricted to those tolerant of the effects of surface mining and smelting activities.

Impacted, severely. Severely impacted soils have substantial barren areas, and the species present are only those that can tolerate the extreme effects of surface mining and smelting activities.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low

0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Interfluve. An elevated area between two drainageways that sheds water to those drainageways.

Intermittent stream. A stream, or reach of a stream, that flows for prolonged periods only when it receives ground-water discharge or long, continued contributions from melting snow or other surface and shallow subsurface sources.

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, plants invade following disturbance of the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are:

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Kame. A moundlike hill of glacial drift, composed chiefly of stratified sand and gravel.

Kame terrace. A terracelike ridge consisting of stratified sand and gravel that were deposited by a meltwater stream flowing between a melting glacier and a higher valley wall or lateral moraine and that remained after the disappearance of the ice. It is commonly pitted with kettles and has an irregular ice-contact slope.

Lacustrine deposit. Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Lake plain. A surface marking the floor of an extinct lake, filled in by well-sorted, stratified sediments.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Lateral moraine. A ridgelike moraine carried on and deposited at the side margin of a valley glacier. It is composed chiefly of rock fragments derived from the valley walls by glacial abrasion and plucking or by mass wasting.

Leaching. The removal of soluble material from soil or other material by percolating water.

Linear extensibility. Refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. Linear extensibility is

used to determine the shrink-swell potential of soils. It is an expression of the volume change between the water content of the clod at $\frac{1}{3}$ - or $\frac{1}{10}$ -bar tension (33kPa or 10kPa tension) and oven dryness. Volume change is influenced by the amount and type of clay minerals in the soil. The volume change is the percent change for the whole soil. If it is expressed as a fraction, the resulting value is COLE, coefficient of linear extensibility.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loamy soil. Coarse sandy loam, sandy loam, fine sandy loam, very fine sandy loam, loam, silt loam, silt, clay loam, sandy clay loam, or silty clay loam.

Loess. Fine-grained material, dominantly of silt-sized particles, deposited by wind.

Low-residue crops. Such crops as corn used for silage, peas, beans, and potatoes. Residue from these crops is not adequate to control erosion until the next crop in the rotation is established. These crops return little organic matter to the soil.

Low strength. The soil is not strong enough to support loads.

Marl. An earthy, unconsolidated deposit consisting chiefly of calcium carbonate mixed with clay in approximately equal amounts.

Masses. Concentrations of substances in the soil matrix that do not have a clearly defined boundary with the surrounding soil material and cannot be removed as a discrete unit. Common compounds making up masses are calcium carbonate, gypsum or other soluble salts, iron oxide, and manganese oxide. Masses consisting of iron oxide or manganese oxide generally are considered a type of redox concentration.

Mean annual increment (MAI). The average annual increase in volume of a tree during its entire life.

Mechanical treatment. Use of mechanical equipment for seeding, brush management, and other management practices.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Merchantable trees. Trees that are of sufficient size to be economically processed into wood products.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Microhigh. An area that is 2 to 12 inches higher than the adjacent microlow.

Microlow. An area that is 2 to 12 inches lower than the adjacent microhigh.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Miscellaneous water. A sewage lagoon, an industrial waste pit, a fish hatchery, or a similar water area.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately deep soil. A soil that is 20 to 40 inches deep over bedrock or to other material that restricts the penetration of plant roots.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

Mollic epipedon. A thick, dark, humus-rich surface horizon (or horizons) that has high base saturation and pedogenic soil structure. It may include the upper part of the subsoil.

Moraine. An accumulation of glacial drift in a topographic landform of its own, resulting chiefly from the direct action of glacial ice. Some types are lateral, recessional, and terminal.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Areas of color that differ from the matrix color. These colors are commonly attributes retained from the geologic parent material. (See Redox features for indications of poor aeration and impeded drainage.)

Mountain. A natural elevation of the land surface, rising more than 1,000 feet above surrounding lowlands, commonly of restricted summit area (relative to a plateau) and generally having steep sides. A mountain can occur as a single, isolated mass or in a group forming a chain or range.

Muck. Dark, finely divided, well-decomposed organic soil material. (See Sapric soil material.)

Mudstone. Sedimentary rock formed by induration of silt and clay in approximately equal amounts.

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Natric horizon. A special kind of argillic horizon that contains enough exchangeable sodium to have an adverse effect on the physical condition of the subsoil.

Naturalized pasture. Forestland that is used primarily for the production of forage for grazing by livestock rather than for the production of wood products. Overstory trees are removed or managed to promote the native and introduced understory vegetation occurring on the site. This vegetation is managed for its forage value through the use of grazing management principles.

Neutral soil. A soil having a pH value of 6.6 to 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Observed rooting depth. Depth to which roots have been observed to penetrate.

Organic matter. Plant and animal residue in the soil in various stages of decomposition. The content of organic matter in the surface layer is described as follows:

Very low	less than 0.5 percent
Low	0.5 to 1.0 percent
Moderately low	1.0 to 2.0 percent
Moderate	2.0 to 4.0 percent
High	4.0 to 8.0 percent
Very high	more than 8.0 percent

Outwash plain. An extensive area of glaciofluvial material that was deposited by meltwater streams.

Overstory. The trees in a forest that form the upper crown cover.

Oxbow. The horseshoe-shaped channel of a former meander, remaining after the stream formed a cutoff across a narrow meander neck.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan*, *fragipan*, *claypan*, *plowpan*, and *traffic pan*.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The movement of water through the soil.

Permeability. The quality of the soil that enables water or air to move downward through the profile.

Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Phase, soil. A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and flooding.

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plasticity index. The numerical difference between the liquid limit and the plastic limit. The range of moisture content within which the soil remains plastic.

Playa. The generally dry and nearly level lake plain that occupies the lowest parts of closed depressional areas, such as those on intermontane basin floors.

Temporary flooding occurs primarily in response to precipitation and runoff.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poorly graded. Refers to a coarse-grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Potential natural community (PNC). The biotic community that would become established on an ecological site if all successional sequences were completed without interferences by man under the present environmental conditions. Natural disturbances are inherent in its development. The PNC may include acclimatized or naturalized nonnative species.

Potential rooting depth (effective rooting depth). Depth to which roots could penetrate if the content of moisture in the soil were adequate. The soil has no properties restricting the penetration of roots to this depth.

Prescribed burning. The application of fire to land under such conditions of weather, soil moisture, and time of day as presumably will result in the intensity of heat and spread required to accomplish specific forest management, wildlife, grazing, or fire hazard reduction purposes.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Proper grazing use. Grazing at an intensity that maintains enough cover to protect the soil and maintain or improve the quantity and quality of the desirable vegetation. This practice increases the vigor and reproduction capacity of the key plants and promotes the accumulation of litter and mulch necessary to conserve soil and water.

Quartzite, metamorphic. Rock consisting mainly of quartz that formed through recrystallization of quartz-rich sandstone or chert.

Quartzite, sedimentary. Very hard but unmetamorphosed sandstone consisting chiefly of quartz grains.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. (See Similarity index.)

Range site. (See Ecological site.)

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Ultra acid	less than 3.5
Extremely acid	3.5 to 4.4
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Moderately acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Slightly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Recessional moraine. A moraine formed during a temporary but significant halt in the retreat of a glacier.

Red beds. Sedimentary strata that are mainly red and are made up largely of sandstone and shale.

Redox concentrations. Nodules, concretions, soft masses, pore linings, and other features resulting from the accumulation of iron or manganese oxide. An indication of chemical reduction and oxidation resulting from saturation.

Redox depletions. Low-chroma zones from which iron and manganese oxide or a combination of iron and manganese oxide and clay has been removed. These zones are indications of the chemical reduction of iron resulting from saturation.

Redox features. Redox concentrations, redox depletions, reduced matrices, a positive reaction to alpha,alpha-dipyridyl, and other features indicating the chemical reduction and oxidation of iron and manganese compounds resulting from saturation.

Reduced matrix. A soil matrix that has low chroma in situ because of chemically reduced iron (Fe II). The chemical reduction results from nearly continuous wetness. The matrix undergoes a change in hue or chroma within 30 minutes after exposure to air as the iron is oxidized (Fe III). A type of redox feature.

Regeneration. The new growth of a natural plant community, developing from seed.

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relict stream terrace. One of a series of platforms in or adjacent to a stream valley that formed prior to the current stream system.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep-sided channel resulting from accelerated erosion. A rill generally is a few inches deep and not wide enough to be an obstacle to farm machinery.

Riser. The relatively short, steeply sloping area below a terrace tread that grades to a lower terrace tread or base level.

Riverwash. Unstable areas of sandy, silty, clayey, or gravelly sediments. These areas are flooded, washed, and reworked by rivers so frequently that they support little or no vegetation.

Road cut. A sloping surface produced by mechanical means during road construction. It is commonly on the uphill side of the road.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, boulders, stones, cobbles, and gravel.

Rock outcrop. Exposures of bare bedrock other than lava flows and rock-lined pits.

Root zone. The part of the soil that can be penetrated by plant roots.

Rubble land. Areas that have more than 90 percent of the surface covered by stones or boulders. Voids contain no soil material and virtually no vegetation other than lichens. The areas commonly are at the base of mountain slopes, but some are on mountain slopes as deposits of cobbles, stones, and boulders left by Pleistocene glaciation or by periglacial phenomena.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Salinity. The electrical conductivity of a saline soil. It is expressed, in millimhos per centimeter, as follows:

Nonsaline	0 to 4
Slightly saline	4 to 8
Moderately saline	8 to 16
Strongly saline	more than 16

Sand. As a soil separate, individual rock or mineral fragments from 0.05 to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Sandy soil. Sand or loamy sand.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Saturation. Wetness characterized by zero or positive pressure of the soil water. Under conditions of saturation, the water will flow from the soil matrix into an unlined auger hole.

Sawlogs. Logs of suitable size and quality for the production of lumber.

Scarification. The act of abrading, scratching, loosening, crushing, or modifying the surface to increase water absorption or to provide a more tillable soil.

Scribner's log rule. A method of estimating the number of board feet that can be cut from a log of a given diameter and length.

Sedimentary plain. An extensive nearly level to gently rolling or moderately sloping area that is underlain by sedimentary bedrock and that has a slope of 0 to 8 percent.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Sedimentary uplands. Land areas of bedrock formed from water- or wind-deposited sediments. They are higher on the landscape than the flood plain.

Seepage (in tables). The movement of water through soil. Seepage adversely affects the specified use.

Semiconsolidated sedimentary beds. Soft geologic sediments that disperse when fragments are placed in water. The fragments are hard or very hard when dry. Determining the texture by the usual field method is difficult.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Shallow soil. A soil that is 10 to 20 inches deep over bedrock or to other material that restricts the penetration of plant roots.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shelterwood system. A forest management system requiring the removal of a stand in a series of cuts so that regeneration occurs under a partial canopy. After regeneration, a final cut removes the shelterwood and allows the stand to develop in the open as an even-aged stand. The system is well suited to sites where shelter is needed for regeneration, and it can aid regeneration of the more intolerant tree species in a stand.

Shoulder. The uppermost inclined surface at the top of a hillside. It is the transitional zone from the backslope to the summit of a hill or mountain. The surface is dominantly convex in profile and erosional in origin.

Shrink-swell (in tables). The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Side slope. A geomorphic component of hills consisting of a laterally planar area of a hillside. The overland waterflow is predominantly parallel.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeters) to the lower limit of very fine sand (0.05 millimeters). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Similarity index. A similarity index is the percentage of a specific vegetation state plant community that is presently on the site.

Sinkhole. A depression in the landscape where limestone has been dissolved.

Site class. A grouping of site indexes into five to seven production capability levels. Each level can be represented by a site curve.

Site curve (50-year). A set of related curves on a graph that shows the average height of dominant or dominant and codominant trees for the range of ages on soils that differ in productivity. Each level is represented by a curve. The basis of the curves is the height of dominant or dominant and codominant trees that are 50 years old or are 50 years old at breast height.

Site curve (100-year). A set of related curves on a graph that shows the average height of dominant or dominant and codominant trees for a range of ages on soils that differ in productivity. Each level is represented by a curve. The basis of the curves is the height of dominant or dominant and codominant trees that are 100 years old or are 100 years old at breast height.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant or dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75.

Skid trails. Pathways along which logs are dragged to a common site for loading onto a logging truck.

Slash. The branches, bark, treetops, reject logs, and broken or uprooted trees left on the ground after logging.

Slickens. Accumulations of fine textured material, such as material separated in placer-mine and ore-mill operations. Slickens from ore mills commonly consist of freshly ground rock that has undergone chemical treatment during the milling process.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slickspot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil generally is loamy or clayey, is slippery when wet, and is low in productivity.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance. In this survey the following slope classes are recognized:

Nearly level	0 to 2 percent
Gently sloping	2 to 4 percent
Moderately sloping	4 to 8 percent
Strongly sloping	8 to 15 percent
Moderately steep	15 to 25 percent
Steep	25 to 45 percent
Very steep	more than 45 percent

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Sodic (alkali) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Sodicity. The degree to which a soil is affected by exchangeable sodium. Sodicity is expressed as a sodium adsorption ratio (SAR) of a saturation extract, or the ratio of Na^+ to $\text{Ca}^{++} + \text{Mg}^{++}$. The degrees of sodicity and their respective ratios are:

Slight	less than 13:1
Moderate	13-30:1
Strong	more than 30:1

Sodium adsorption ratio (SAR). A measure of the amount of sodium (Na) relative to calcium (Ca) and magnesium (Mg) in the water extract from saturated soil paste. It is the ratio of the Na concentration divided by the square root of one-half of the Ca + Mg concentration.

Soft bedrock. Bedrock that can be excavated with trenching machines, backhoes, small rippers, and other equipment commonly used in construction.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the material below the solum. The living roots and plant and animal activities are largely confined to the solum.

Species. A single, distinct kind of plant or animal having certain distinguishing characteristics.

Stone line. A concentration of coarse fragments in a soil. Generally, it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with tillage, or stones cover .01 to 0.1 percent of the surface. Very stony means that 0.1 to 3.0 percent of the surface is covered with stones. Extremely stony means that 3 to 15 percent of the surface is covered with stones.

Stony soil material. Soil that is 15 to 35 percent, by volume, rock fragments that are dominated by fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Strath terrace. A surface cut formed by the erosion of hard or semiconsolidated bedrock and thinly mantled with stream deposits.

Stream channel. The hollow bed where a natural stream of surface water flows or may flow; the deepest or central part of the bed, formed by the main current and covered more or less continuously by water.

- Stream terrace.** One of a series of platforms in a stream valley, flanking and more or less parallel to the stream channel. It originally formed near the level of the stream and is the dissected remnants of an abandoned flood plain, streambed, or valley floor that were produced during a former stage of erosion or deposition.
- Stripcropping.** Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to soil blowing and water erosion.
- Structure, soil.** The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are *platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).
- Stubble mulch.** Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind erosion and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.
- Subsoil.** Technically, the B horizon; roughly, the part of the solum below plow depth.
- Subsoiling.** Tilling a soil below normal plow depth, ordinarily to shatter or loosen a layer that is restrictive to roots.
- Substratum.** The part of the soil below the solum.
- Subsurface layer.** Any surface soil horizon (A, E, AB, or EB) below the surface layer.
- Summer fallow.** The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.
- Summit.** A general term for the top, or highest level, of an upland feature, such as a hill or mountain. It commonly refers to a higher area that has a gentle slope and is flanked by steeper slopes.
- Surface layer.** The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."
- Tailwater.** The water directly downstream of a structure.
- Talus.** Rock fragments of any size or shape, commonly coarse and angular, derived from and lying at the base of a cliff or very steep rock slope. The accumulated mass of such loose, broken rock formed chiefly by falling, rolling, or sliding.
- Taxadjuncts.** Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.
- Terminal moraine.** A belt of thick glacial drift that generally marks the termination of important glacial advances.
- Terrace.** An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field generally is built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.
- Terrace (geologic).** An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.
- Terracette.** Small, irregular step-like forms on steep hillslopes, especially in pasture, formed by creep or erosion of surficial materials that may or may not be induced by trampling of livestock such as sheep or cattle.
- Texture, soil.** The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles,

are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying “coarse,” “fine,” or “very fine.”

Thin layer (in tables). A layer of otherwise suitable soil material that is too thin for the specified use.

Till plain. An extensive, nearly level to gently rolling or moderately sloping area that is underlain by or consists of till and that has a slope of 0 to 8 percent.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toeslope. The outermost inclined surface at the base of a hill. Toeslopes are commonly gentle and linear in profile.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.

Trafficability. The degree to which a soil is capable of supporting vehicular traffic across a wide range in soil moisture conditions.

Tread. The relatively flat terrace surface that was cut or built by stream or wave action.

Tuff. A compacted deposit that is 50 percent or more volcanic ash and dust.

Understory. Any plants in a forest community that grow to a height of less than 5 feet.

Upland. Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley. An elongated depressional area primarily developed by stream action.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial meltwater. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Varve. A sedimentary layer or a lamina or sequence of laminae deposited in a body of still water within a year. Specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by meltwater streams, in a glacial lake or other body of still water in front of a glacier.

Very deep soil. A soil that is more than 60 inches deep over bedrock or to other material that restricts the penetration of plant roots.

Very shallow soil. A soil that is less than 10 inches deep over bedrock or to other material that restricts the penetration of plant roots.

Water bars. Smooth, shallow ditches or depressional areas that are excavated at an angle across a sloping road. They are used to reduce the downward velocity of water and divert it off and away from the road surface. Water bars can easily be driven over if constructed properly.

Water-spreading. Diverting runoff from natural channels by means of a system of dams, dikes, or ditches and spreading it over relatively flat surfaces.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

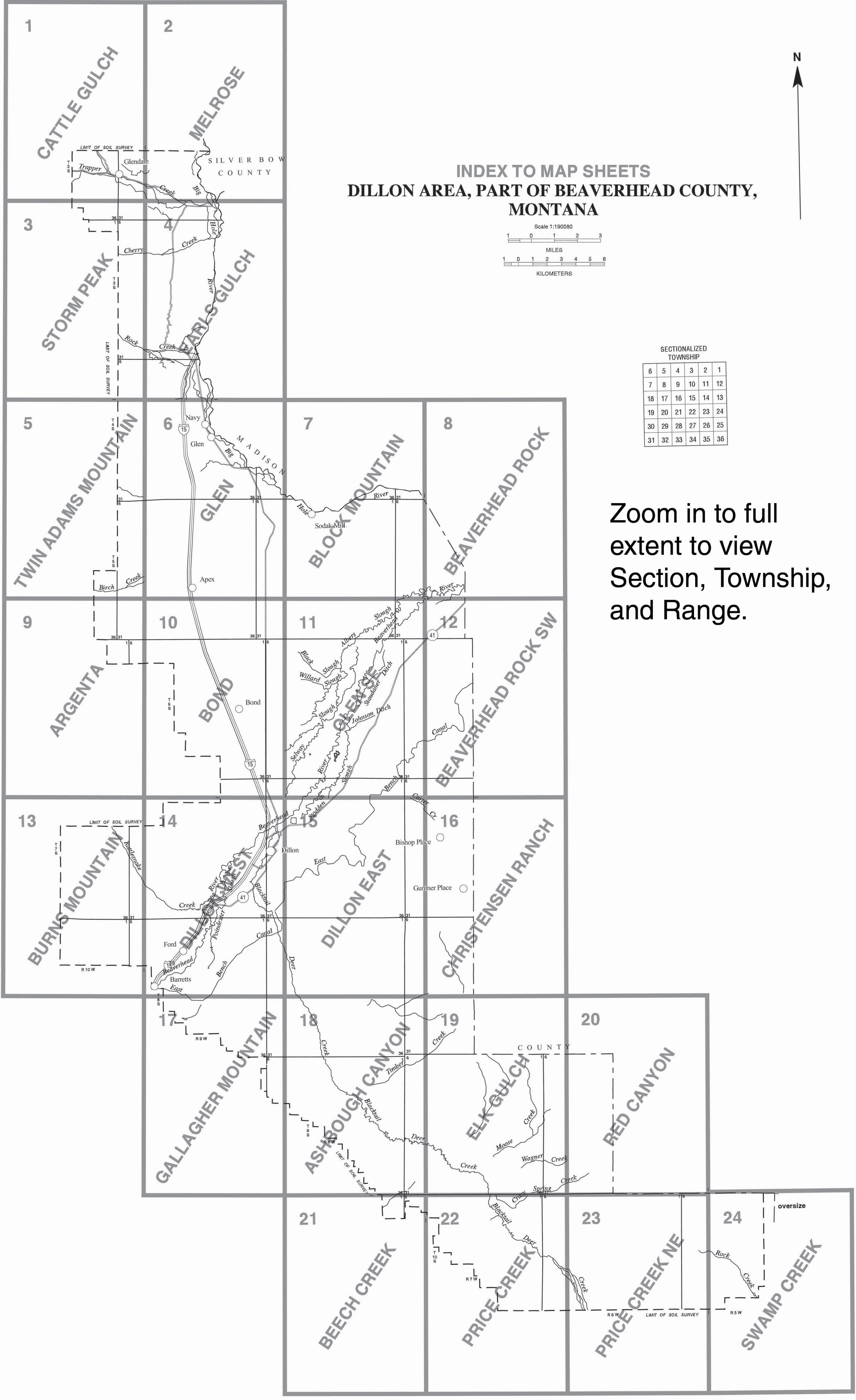
Well graded. Refers to soil material consisting of coarse-grained particles that are well distributed over wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an oven-dry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Windthrow. The action of uprooting and tipping over trees by the wind.

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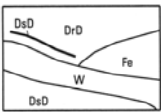





















SOIL LEGEND

The publication symbols consist of field symbols. Symbols consist of numbers or a combination of numbers and letters, for example, 18A, 266D, 2, and 1823F. For the symbols designated by a number and a letter, the number designates the soil type and the letter designates the slope class. The symbols without a number designate a miscellaneous area. Map units are arranged numerically by field symbols.

SYMBOL	NAME	SYMBOL	NAME	SYMBOL	NAME
1E	Kounter-Rock outcrop complex, 15 to 45 percent slopes	40E	Philipsburg-Tiban-Adel complex, 15 to 45 percent slopes	198E	Cabbart, very stony-Rentsac, bouldery-Rock outcrop complex, 15 to 45 percent slopes
2D	Kounter-Rock outcrop complex, 4 to 15 percent slopes	41E	Bronec, Amesha, and Riverrun, channelled soils, 0 to 35 percent slopes	217B	Havre-Glendive complex, 0 to 4 percent slopes
4E	Libeg, very stony-Oro Fino-Poin, stony complex, 15 to 60 percent slopes	42E	Spudbar, extremely bouldery-Rubble land-Rock outcrop complex, 15 to 45 percent slopes	225B	Scravo cobbly loam, 0 to 4 percent slopes
5E	Barbarela-Poin, flaggy complex, 15 to 35 percent slopes	44E	Tiban-Philipsburg-Roxal complex, 15 to 45 percent slopes	227B	Bronec cobbly loam, 0 to 4 percent slopes
6E	Cheadle family, very stony-Rock outcrop complex, 25 to 60 percent slopes	45E	Maciver gravelly loam, 1 to 4 percent slopes	227C	Bronec-Kalsted gravelly sandy loams, stony, 2 to 8 percent slopes
7B	Trudau loam, cool, 2 to 8 percent slopes	47D	Spudbar complex, 2 to 15 percent slopes	233C	Varney-Sappington-Kalsted, stony complex, 2 to 8 percent slopes
8A	Beavrock-Ashbough complex, 0 to 2 percent slopes	49E	Geohrock very cobbly loam, very stony, 15 to 35 percent slopes	241F	Whitlash, very stony-Rock outcrop-Perma, very stony complex, 25 to 60 percent slopes
9B	Threeriv-Beavrock complex, 0 to 2 percent slopes	53E	Hanson-Rock outcrop complex, 25 to 45 percent slopes	242B	Beavrock-Dillon silt loams, 0 to 4 percent slopes
10B	Ryell-Rivra complex, 0 to 4 percent slopes	58A	Havre loam, cool, 0 to 2 percent slopes	270E	Pensore-Crago-Rock outcrop complex, 8 to 45 percent slopes
10D	Crago complex, 4 to 10 percent slopes	60C	Kalsted loamy sand, 2 to 8 percent slopes	272F	Rencot, stony-Spudbar-Rock outcrop complex, 25 to 50 percent slopes
11B	Rivra, cool-Beavrock complex, 0 to 4 percent slopes	61A	Kalsted sandy loam, 0 to 2 percent slopes	277C	Sappington-Kalsted-Kalsted, stony complex, 2 to 8 percent slopes
11D	Barbarela-Foolhen complex, 2 to 15 percent slopes	62C	Kalsted sandy loam, 2 to 8 percent slopes	278D	Sappington-Geohrock-Delpoint, stony complex, 4 to 25 percent slopes
12C	Attewan cobbly loam, cool, 2 to 8 percent slopes	63D	Kalsted sandy loam, 8 to 15 percent slopes	289E	Geohrock-Bronec-Geohrock, stony complex, 8 to 45 percent slopes
14E	Hanson complex, 8 to 25 percent slopes	64E	Kalsted gravelly sandy loam, 15 to 35 percent slopes	291E	Haxby-Blackleaf-Zbart complex, 4 to 25 percent slopes
15B	Glendive sandy loam, 0 to 4 percent slopes	77C	Sappington loam, 2 to 8 percent slopes	327E	Bronec-Spudbar-Rencot complex, 8 to 35 percent slopes
17A	Beavwan-Sieberell complex, 1 to 4 percent slopes	83A	Dillon silt loam, 0 to 2 percent slopes	331C	Geohrock-Bronec gravelly loams, 2 to 8 percent slopes
18E	Libeg, stony-Poin, very stony-Rock outcrop complex, 25 to 60 percent slopes	84A	Madbeaver silt loam, 0 to 2 percent slopes	333E	Varney-Delpoint, stony-Geohrock complex, 4 to 35 percent slopes
19D	Blaine stony loam, 2 to 15 percent slopes	85C	Trudau loam, 2 to 8 percent slopes	335E	Kalsted-Scravo, stony-Cabbart complex, 15 to 45 percent slopes
20F	Whitore gravelly loam, 25 to 60 percent slopes, stony	89D	Nuley sandy loam, 2 to 12 percent slopes	336D	Amesha-Bronec-Sappington complex, 4 to 15 percent slopes
21B	Thess loam, cool, 0 to 4 percent slopes	90C	Nuley clay loam, 2 to 8 percent slopes	372E	Rencot-Spudbar-Rock outcrop complex, 8 to 25 percent slopes
22E	Tiban, very stony-Maciver complex, 15 to 60 percent slopes	91E	Nuley-Rock outcrop complex, 8 to 35 percent slopes	433D	Varney-Udecide-Geohrock complex, 4 to 15 percent slopes
23B	Newtman-Dougcliff complex, 0 to 4 percent slopes	110A	Ryell-Rivra complex, cool, 0 to 2 percent slopes	436D	Amesha-Haxby-Rencot complex, 4 to 15 percent slopes
23C	Bridger clay loam, 2 to 8 percent slopes	112B	Rivra complex, 0 to 4 percent slopes	533D	Varney-Kalsted, stony-Cabbart, stony complex, 4 to 15 percent slopes
24C	Kalsted-Sappington complex, 2 to 8 percent slopes	118B	Neen-Ashbough, saline-Beavrock complex, 0 to 4 percent slopes	535D	Kalsted-Blacksheep-Rock outcrop complex, 4 to 15 percent slopes
25E	Scravo, stony-Kalsted-Cabbart, 15 to 45 percent slopes	117B	Ashbough silt loam, 0 to 4 percent slopes	537P	Elve-Gambler-Libeg families complex, moderately steep mountain slopes
27D	Barbarela-Nieman-Oro Fino complex, 2 to 15 percent slopes	127A	Bronec gravelly sandy loam, 0 to 2 percent slopes	541D	Whitlash, very stony-Brickner, stony-Rock outcrop complex, 4 to 25 percent slopes
27E	Bronec very cobbly loam, 8 to 35 percent slopes	127C	Bronec gravelly sandy loam, 2 to 8 percent slopes	586B	Rominell loam, 0 to 4 percent slopes
28C	Beavwan gravelly sandy loam, 2 to 8 percent slopes	130A	Thess-Ashbough complex, 0 to 2 percent slopes	627C	Bronec-Kalsted gravelly sandy loams, 2 to 8 percent slopes
29E	Poin, flaggy-Barbarela-Rock outcrop complex, 8 to 25 percent slopes	130B	Thess-Scravo complex, 0 to 4 percent slopes	627D	Bronec-Kalsted complex, 4 to 15 percent slopes
29F	Brocko-Crago complex, cool, 8 to 45 percent slopes	133C	Varney-Sappington complex, 2 to 8 percent slopes	927E	Bronec-Trimad-Kalsted complex, 15 to 45 percent slopes
30B	Thess loam, 0 to 4 percent slopes	135D	Kalsted gravelly sandy loam, 4 to 15 percent slopes	998E	Libeg-Nieman, stony complex, 8 to 25 percent slopes
30E	Nieman, very stony-Rock outcrop complex, 8 to 60 percent slopes	136C	Amesha-Kalsted complex, 2 to 8 percent slopes	999E	Ermont-Rock outcrop-Ratiopeak complex, 4 to 35 percent slopes
31A	Ashbough silt loam, 0 to 2 percent slopes	142B	Beavrock-Threeriv silt loams, 0 to 4 percent slopes	1003E	Tiban, bouldery-Cheadle, very bouldery complex, 15 to 35 percent slopes
32B	Yamacall loam, 0 to 4 percent slope	147C	Varney clay loam, 2 to 8 percent slopes	1690F	Cheadle, very stony-Rock outcrop-Tiban, bouldery complex, 15 to 45 percent slopes
32E	Fourmile complex, 8 to 25 percent slopes	148E	Rentsac, extremely bouldery-Rock outcrop complex, 15 to 45 percent slopes	2125F	Rubble land-Elve, very stony-Rock outcrop complex, 25 to 60 percent slopes
33E	Shadow complex, 15 to 70 percent slopes	177C	Sappington-Kalsted complex, 2 to 8 percent slopes	2213E	Sebud, stony-Surdal, stony-Poin, very stony complex, 8 to 35 percent slopes
34C	Nippt-Scravo gravelly loams, 1 to 4 percent slopes	180B	Thessvo-Scravo complex, 0 to 4 percent slopes	2712D	Libeg-Mooseflat loams, 4 to 25 percent slopes
35B	Kalsted sandy loam, 0 to 4 percent slopes	181B	Nippt-Scravo-Nippt complex, 0 to 4 percent slopes	9100F	Blackleaf, stony-Twinadams, very stony-Rock outcrop complex, 20 to 60 percent slopes
35C	Kalsted sandy loam, 4 to 8 percent slopes	182B	Dillon-Ashbough-Beavrock silt loams, 0 to 4 percent slopes	9101E	Twinadams-Thunderhead-Blackleaf, stony complex, 8 to 25 percent slopes
36B	Amesha loam, 0 to 4 percent slopes	183B	Dillon-Rivra-Beavrock complex, 0 to 4 percent slopes	9102F	Nathale, very bouldery-Poin, very flaggy-Rock outcrop complex, 15 to 45 percent slopes
36C	Amesha loam, 4 to 8 percent slopes	187C	Chinook-Glendive sandy loams, 0 to 8 percent slopes	9103D	Faith-Geohrock, stony-Beavrock complex, 2 to 15 percent slopes
36E	Kounter-Amesha-Rock outcrop complex, 8 to 35 percent slopes	189E	Geohrock, bouldery-Sappington, stony-Bronec, bouldery complex, 8 to 35 percent slopes	9105F	Ratiopeak, bouldery-Poin, flaggy complex, 15 to 45 percent slopes
37B	Brockway silt loam, 0 to 4 percent slopes	190E	Blackleaf, stony-Twinadams-Rock outcrop complex, 8 to 35 percent slopes	DA	Denied access
37C	Tiban-Maciver gravelly loams, 2 to 8 percent slopes	191D	Haxby-Kalsted-Zbart complex, 4 to 15 percent slopes	GP	Gravel pits
37E	Crago-Scravo complex, 15 to 45 percent slopes	193A	Attewan-Nippt complex, 0 to 2 percent slopes	M-W	Miscellaneous water
38D	Philipsburg gravelly loam, 2 to 15 percent slopes	194D	Musselshell-Roto-Pensore complex, 4 to 15 percent slopes	W	Water
39C	Trimad gravelly loam, 2 to 8 percent slopes	195B	Dillon, saline-Dillon-Riverrun, saline complex, 0 to 4 percent slopes		

CONVENTIONAL AND SPECIAL
SYMBOLS LEGEND
SOIL SURVEY FEATURES

SOIL DELINEATIONS AND SYMBOLS		CULTURAL FEATURES	
		BOUNDARIES	
		County or parish	
		Reservation (national or state forest or park)	
		Limit of soil survey (label)	
		Public land survey system section boundary	
STANDARD LANDFORM AND MISCELLANEOUS SURFACE FEATURES		ROAD EMBLEMS & DESIGNATIONS	
Escarpment, bedrock		Interstate	
Gravel pit		Federal	
Gravelly spot		State	
Rock outcrop			
Saline spot			
Short steep slope			
Slide or slip			
Sodic spot			
Stony spot			
Very stony spot			
Wet spot			
AD HOC FEATURES			
Boulder			

Symbol Definitions

LABEL	NAME	DESCRIPTION
⊕	Boulder	A spot where 0.1 to 3 percent of the surface cover is rock fragments that are greater than 26 inches in diameter where the surrounding soil has less than 0.01 percent of the surface cover of stones. Typically 1 to 5 acres.
YAYAYAYAYAYAY	Escarpment, bedrock	A relatively continuous and steep slope or cliff, which was produced by erosion or faulting, that breaks the general continuity of more gently sloping land surfaces. Exposed material is hard or soft bedrock.
×	Gravel pit	An open excavation from which soil and underlying material have been removed and used, without crushing, as a source of sand or gravel. Typically less than 5 acres.
⋄	Gravelly spot	A spot where the surface layer has more than 35 percent, by volume, rock fragments that are mostly less than 3 inches in diameter in an area of surrounding soil with less than 15 percent fragments. Typically less than 5 acres.
▼	Rock outcrop	An exposure of bedrock at the surface of the earth. Not used where the named soils of the surrounding map unit are shallow over bedrock or where “Rock outcrop” is a named component of the map unit. Typically less than 5 acres.
+	Saline spot	An area where the surface layer has an electrical conductivity (EC) of 8 mmhos cm ⁻¹ more than the surface layer of the named soils in the surrounding map unit, which have an EC of 2 mmhos cm ⁻¹ or less. Typically less than 5 acres.
.....	Short, steep slope	Narrow soil area that has slopes that are at least two slope classes steeper than the slope class of the surrounding map unit.
Ꞥ	Slide or slip	A prominent landform scar or ridge caused by fairly recent mass movement or descent of earthy material resulting from failure of earth or rock under shear stress along one or several surfaces. Typically less than 5 acres.
∅	Sodic spot	An area where the surface layer has a sodium adsorption ratio that is at least 10 more than the surface layer of the named soils in the surrounding map unit, which have a sodium adsorption ratio of 5 or less. Typically less than 5 acres.
◊	Stony spot	A spot where 0.01 to 0.10 percent of the surface cover is rock fragments that are greater than 10 inches in diameter in areas where the surrounding soil has no surface stones. Typically less than 5 acres.
Ⓢ	Very stony spot	A spot where 0.1 to 3.0 percent of the surface cover is rock fragments that are greater than 10 inches in diameter in areas where the surrounding soil has less than 0.01 percent of a surface cover of stones. Typically 1 to 5 acres.
↓	Wet spot	A somewhat poorly drained to very poorly drained area that is at least two drainage classes wetter than the named soils in the surrounding map unit. Typically less than 5 acres.